Five-Year Review Report

Third Five-Year Review Report

for

LEMBERGER LANDFILL (LEMBERGER FLYASH)

LEMBERGER TRANSPORT AND RECYCLING

Franklin Township, Manitowoc County, Wisconsin

July 2010

PREPARED BY:

**The United States Environmental Protection Agency, Region 5
Chicago, IL**

Approved by: Richard Karl

Richard Karl, Director
Superfund Division

Date: 7-14-10

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Five-Year Review Report

Table of Contents

Tables

Exhibits

monitoring program, RMT, August 28, 2008.

Exhibit 18: Figure 3, State Restrictions and Deed Restriction Areas with TCE Plume, letter re: LL and LTR five-year review, RMT, April 23, 2010.

Exhibit 19: ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANT, Document 1065459, Attorney Douglas B. Clark, May 20, 2009.

Exhibit 20: ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANT, Document 1065460, Attorney Douglas B. Clark, May 20, 2009.

Exhibit 21: EPA Begins Review of Lemberger Superfund Sites, Herald Times Reporter, February 15, 2010.

Exhibit 22: Figure 3, Historic Groundwater Analytical Results for Bis(2-ethylhexyl)phthalate, RMT letter, April 23, 2010.

Exhibit 23: Figure 2, 1,1,1-TCA Concentration LGU and Bedrock Unit – July 2008, responses to February 19, 2009 EPA letter regarding MNA Report, RMT, April 17, 2009.

Exhibit 24: Figure 3, 1,1-DCA Concentration LGU and Bedrock Unit – July 2008, responses, April 17, 2009.

Exhibit 25: Figure 4, TCE Concentration LGU and Bedrock Unit, responses – July 2008, responses, April 17, 2009.

Exhibit 26: Figure 5, Cis-1,2-Dichloroethylene Concentration LGU and Bedrock Unit – July 2008, responses, April 17, 2009.

Exhibit 27: VOC Concentration Trends for pumping and monitoring wells from 1996 – 2009, April 23, 2010 letter, RMT (108 plots).

Exhibit 28: Memorandum re: April 7, 2010 site inspection at LL and LTR, EPA.

Exhibit 29: Figure 1, Slurry Wall Completion / Foundation Map, *Leachate Head Evaluation Report*, October 2007.

Exhibit 30: Figure 5, Revised Lemberger Landfill Conceptual Liquids Balance, *Leachate Head Evaluation Report for the Lemberger Landfill*, RMT, February 2010.

Exhibit 31: Figure 1, Lemberger Landfill Plan View, *Leachate Head Evaluation Report for the Lemberger Landfill*, February 2010.

Exhibit 32: Table 2, Leachate Analytical Summary, *Leachate Head Evaluation Report for the Lemberger Landfill*, February 2010.

Exhibit 33: Summary of Sen's Slope Statistical Analyses, RMT submittal, April 17, 2009.

Exhibit 34: Figure 7, Conceptual Model - VOC Sources at LTR, *Assessment of Remedial Action Effectiveness*, RMT, June 2004.

Exhibit 35: Figure 1, Trends in Ratio Between Cis 1,2 DCE and TCE, RMT submittal, April 17, 2009 .

Exhibit 36: As-built drawing of LTR site cover, RMT, December 20, 1995

Exhibit 37: Figure 4-13, Organic Analytical Results Summary for Sediment, Surface Water, and Leachate, RI.

Exhibit 38: Table 1, WAC NR 140.10.

List of Acronyms

BEHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
Cis	cis-1,2-dichloroethylene
cm/sec	centimeters per second
CO_2	carbon dioxide
cPAHs	carcinogenic polyaromatic hydrocarbons
CVOCs	chlorinated volatile organic compounds
DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethylene
1,2-DCE	1,2-dichloroethylene (all isomers)
DO	dissolved oxygen
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
ESs	State of Wisconsin Enforcement Standards established pursuant to WAC NR 140
FS	*Final Public Comment Phased Feasibility Study Report for Lemberger Landfill, Inc. and Lemberger Transport & Recycling, Inc. Ground Water and Lemberger Landfill, Inc. Source Control Operable Unit*, B&V Waste Science and Technology Corp., May 10, 1991;
GEOS	Groundwater Evaluation and Optimization System, EPA, Region 5, Superfund
IC	institutional control
In	inches

IRIS	EPA's Integrated Risk Information System
Fe	iron
ft	feet
LGS	lower groundwater system, including the lower granular unit and the dolomite bedrock
LGU	lower granular unit, the unconsolidated part of the LGS
LH	leachate head
LL	Lemberger Landfill, Inc. Site
LSRG	Lemberger Site Remediation Group
LTR	Lemberger Transport and Recycling, Inc. Site
LW	leachate withdrawal
MCLs	Maximum Contaminant Levels, National Primary Drinking Water Standards established pursuant to 40 CFR 120
MDL	Method detection limit
mg/l	milligrams per liter
Mn	manganese
MNA	monitored natural attenuation
MNA Report	*Monitored Natural Attenuation Engineering Demonstration Project Summary Report,* RMT, December 2008
mm	millimeters
mV	millivolts
ND	not detected
NO_3	nitrate
OMP	*Final Operation and Maintenance Plan Lemberger Landfill, RD/RA Operable Unit #1*, and *Final Operation and Maintenance Plan Lemberger*

Transport and Recycling Site, Operable Unit #2

PAHs	polyaromatic hydrocarbons
PALs	State of Wisconsin Preventive Action Limits established pursuant to WAC NR 140
PCBs	polychlorinated biphenyls
PCE	perchloroethylene, tetrachloroethylene
QAPP	quality assurance project plan
RI	*Final Remedial Investigation Report for Lemberger Landfill Inc. and Lemberger Transport and Recycling Inc.Sites*, B&V Waste Science and Technology Corp., January 18, 1991, and *Lemberger Transport and Recycling Inc. Site Source Control Operable Unit Remedial Investigation Technical Memorandum*, B&V Waste Science and Technology Corp., October 1992;
RMT	RMT, Inc.
RPM	EPA's Remedial Project Manager
ROD	Record of Decision
RSLs	EPA Region 3 screening levels for tap water (5/19/2009 update)
SO_4	sulfate
SVE	soil vapor extraction
SVOCs	semivolatile organic compounds
SWCDA	State of Wisconsin Special Well Casing Depth Area
TCA	1,1,1-trichloroethane
TCE	trichloroethylene
TIC	total inorganic carbon
TOC	total organic carbon
ug/l	micrograms per liter

ug/kg	micrograms per kilogram
UGS	upper groundwater system, consisting of perched groundwater in the upper granular unit, and bedrock
UGU	upper granular
UU/UE	unlimited access and unlimited exposure
VOCs	volatile organic compounds
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources
<	the concentration was less than the following value or was not detected with a reported detection limit of the following value

EXECUTIVE SUMMARY

As it did in 2000 and 2005, the U.S. Environmental Protection Agency (EPA) is combining the 2010 five-year reviews for the Lemberger Landfill (LL) and Lemberger Transport and Recycling (LTR) sites.

Releases primarily from LTR have resulted in contamination of groundwater by chlorinated volatile organic compounds (CVOCs). High concentrations of these CVOCs are present at the boundary of LTR, and concentrations exceeding standards extend more than 1.5 miles downgradient to the Branch River. CVOC contamination from LTR migrates under LL, but the CVOC data do not indicate an impact from LL.

In a 1991 Record of Decision (ROD), EPA selected a site cover, fence, slurry wall, and groundwater withdrawal within the slurry wall to contain the LL source (part of Operable Unit (OU) #1). Construction of these measures was completed in 1996. These measures appear to have been effective and are being properly operated and maintained. A proposal to discontinue the leachate withdrawal, which was performed from 1997 through 2008, is under review.

In 1993 – 1994, more than 1500 drums, jars and gas cylinders were removed from LTR, and the site was fenced. In 1995 – 1996 a site cover was constructed over the LTR disposal areas. These actions were implemented pursuant to an Administrative Order by Consent and constitute OU #2. The site cover and fence are being properly maintained, but the groundwater data does not indicate that the waste removal and site cover reduced groundwater contamination.

In the 1991 ROD, EPA selected groundwater pump and treat to clean-up the groundwater from both LL and LTR (part of OU #1). The pump-and-treat system was operated from 1997 until August 2006. Because groundwater contaminant concentrations were only very gradually lowering, and because it was believed that attenuation was occurring primarily through natural processes, EPA approved a temporary cessation of pumping in order to perform a monitored natural attenuation engineering demonstration project (MNA study) in a 2006 Explanation of Significant Differences (ESD). The MNA study was performed from August 2006 through July 2008. The MNA study was properly performed. Since completion of the MNA study, the combined pump-and-treat system has remained off, while the MNA study results have been under review, and evaluation of source control alternatives has been initiated. In the meantime, private wells are being sampled, and adequate institutional controls and an institutional control plan are in place.

Although the zone of groundwater contamination does not appear to be expanding, the results of the MNA study indicate that MNA by itself will not result in cleanup of any significant zone of groundwater in the foreseeable future, and may not be sufficient for protection of groundwater used by existing private wells or for reducing the areas that need to be restricted by institutional controls. Because conditions at LTR are not promising for use of MNA by itself, measures to increase source area hydraulic capture or other source area treatment/containment alternatives need to be evaluated and implemented. The reason the existing pump-and-treat system was only partially effective was because only a fraction of the LTR source area groundwater contamination was being captured.

In addition, improvements to the groundwater monitoring are needed, potential impacts on Branch Creek need to be evaluated, and there should be a contingency to restart the existing pump-and-treat system, if necessary, to protect private wells while further actions are being evaluated.

The remedy at LL and LTR currently protects human health and the environment for the following reasons: the site covers, fence, and institutional controls are preventing direct contact with the contaminated wastes and soil (OU #1 and OU #2); groundwater monitoring has defined the extent of the contamination along the most likely migration pathways (OU #1); existing private wells are being sampled regularly (OU #1); and the State of Wisconsin regulates installation of new wells. In order for the remedy at LL and LTR to be protective in the long-term, the following actions need to be taken to improve OU #1:

- revise the Quality Assurance Project Plan with updated standard operating procedures for analysis of polychlorinated biphenyls, carcinogenic polyaromatic hydrocarbons, pentachlorophenol and bis(2-ethylhexyl)phthalate in groundwater;
- update the groundwater monitoring plan;
- establish a contingency for re-initiation of groundwater pumping;
- establish groundwater CVOC concentrations that will be protective of aquatic life in Branch Creek, and, if necessary, determine the rate of migration of CVOCs into Branch Creek;
- complete review of the need for continued leachate withdrawal at LL, and issue an ESD, if necessary, in which EPA will decide whether it is protective to change certain ROD requirements relative to the slurry wall and leachate withdrawal;
- evaluate options to improve source area groundwater capture or treatment, and issue an ESD, if necessary.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name ***(from WasteLAN)*****: Lemberger Landfill**		
EPA ID ***(from WasteLAN)*****: WID980901243**		
Region: 5	**State: WI**	**City/County: Manitowoc**
SITE STATUS		
NPL status: X Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ☐ Under Construction X Operating ☐ Complete		
Multiple OUs?* YES X NO	**Construction completion date:** __9_ / __9_ / _1996_____	
Has site been put into reuse? ☐ YES X NO		
REVIEW STATUS		
Lead agency: X EPA ☐ State ☐ Tribe ☐ Other Federal Agency ____________________		
Author name: Richard Boice		
Author title: Remedial Project Manager	**Author affiliation: U.S. EPA**	
Review period:** _12_ / _11 / 2009_____ to __7_ / ___ / 2010______		
Date(s) of site inspection: _4__ / _7__ / _2010___		
Type of review: X Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion		
Review number: ☐ 1 (first) ☐ 2 (second) X 3 (third) ☐ Other (specify) __________		
Triggering action: ☐ Actual RA Onsite Construction at OU #____ ☐ Construction Completion ☐ Other (specify) ☐Actual RA Start at OU#____ X Previous Five-Year Review Report		
Triggering action date ***(from WasteLAN)*****:** _9__ / _21__ / _2005_____		
Due date ***(five years after triggering action date)*****:** _9__ / _21__ / _2010_____		

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name ***(from WasteLAN)*****: Lemberger Transport & Recycling**		
EPA ID ***(from WasteLAN)*****: WID056247208**		
Region: 5	**State: WI**	**City/County: Manitowoc**
SITE STATUS		
NPL status: X Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ☐ Under Construction X Operating ☐ Complete		
Multiple OUs?* X YES ☐ NO	**Construction completion date:** _10__ / _22__ / _1996_____	
Has site been put into reuse? ☐ YES ☐ NO		
REVIEW STATUS		
Lead agency: X EPA ☐ State ☐ Tribe ☐ Other Federal Agency ____________________		
Author name: Richard Boice		
Author title: Remedial Project Manager	**Author affiliation: U.S. EPA**	
Review period:** _12 / _11 / 2009___ to __7_ / ___ / _2010__		
Date(s) of site inspection: _4__ / _7__ / 2010__		
Type of review: X Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion		
Review number: ☐ 1 (first) ☐ 2 (second) X 3 (third) ☐ Other (specify) _________		
Triggering action: ☐ Actual RA Onsite Construction at OU #____ ☐Actual RA Start at OU#____ ☐ Construction Completion X Previous Five-Year Review Report ☐ Other (specify)		
Triggering action date ***(from WasteLAN)*****:** _9_ / _21 / _2005_		
Due date ***(five years after triggering action date)*****:** _9_ / _21 / _2010_		

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues:

1. Data quality (current analytical methods for PCBs, cPAHs and pentachlorophenol are not sensitive enough, and laboratory contamination is apparently causing false BEHP detections).
2. Groundwater monitoring to bound the contamination (possibly insufficient monitoring of down-gradient plume and bedrock fracture network, and bedrock surface contour map is out of date).
3. Protection of groundwater for private well users (may have to expand the well restriction zone, possibly insufficient sentinel wells, westward shift in down-gradient contamination, and plan does not add new private wells).
4. Protection of aquatic life in the Branch River (CVOC groundwater concentrations protective of surface water have not been derived, and quantity of CVOCs migrating into the Branch River has not been determined).
5. Containment of LL Leachate (proposed discontinuation of leachate withdrawal is inconsistent with ROD provisions).
6. Operation, maintenance and monitoring of the pump-and-treat system (address deficiencies).
7. Evaluation of LTR source area treatment / containment alternatives (need further evaluation of pump-and-treat expansion and use of alternative technologies).

Recommendations and Follow-up Actions:

1. Revise the QAPP with updated standard operating procedures for analysis of PCBs, cPAHs, pentachlorophenol and BEHP in groundwater.

1,2,3. Update the groundwater monitoring plan.

3. Establish a contingency for re-initiation of groundwater pumping.

4. Establish groundwater CVOC concentrations that are protective of aquatic life in Branch Creek. If necessary, determine the rate of CVOCs migrating into Branch Creek.

5. Complete review of the need for continued leachate withdrawal at LL, and issue an ESD, if necessary, in which EPA will decide whether it is protective to change certain ROD requirements relative to the slurry wall and leachate withdrawal.

6,7. Evaluate options to improve source area groundwater capture, and issue an ESD if necessary.

Protectiveness Statement(s):

The remedy at LL and LTR currently protects human health and the environment for the following reasons: the site covers, fence, and institutional controls are preventing direct contact with the contaminated wastes and soil (OU #1 and OU #2); groundwater monitoring has defined the extent of the contamination along the most likely migration pathways (OU #1); existing private wells are being sampled regularly (OU #1); and the State of Wisconsin regulates installation of new wells. In order for the remedy at LL and LTR to be protective in the long-term, the following actions need to be taken to improve OU #1: revise the Quality Assurance Project Plan with updated standard operating procedures for analysis of polychlorinated biphenyls, carcinogenic polyaromatic hydrocarbons, pentachlorophenol and bis(2-ethylhexyl)phthalate in groundwater; update the groundwater monitoring plan; establish a contingency for re-initiation of groundwater pumping; establish groundwater CVOC concentrations that will be protective of aquatic life in Branch Creek, and, if necessary, determine the rate of migration of CVOCs into Branch Creek; complete review of the need for continued leachate withdrawal at LL, and issue an ESD, if necessary, in which EPA will decide whether it is protective to change certain ROD requirements relative to the slurry wall and leachate withdrawal; evaluate options to improve source area groundwater capture or treatment, and issue an ESD, if necessary.

Other Comments: *Make any other comments here.*

Fill in the data below:

Date of last Regional review of Human Exposure Indicator (from WasteLAN): ___6/17/2009____
Human Exposure Survey Status (from WasteLAN): current human exposure controlled
Date of last Regional review of Groundwater Migration Indicator (from WasteLAN): _ 6/17/2009_
Groundwater Migration Survey Status (from WasteLAN): contaminated groundwater migration under control
Ready for Reuse Determination Status (from WasteLAN): _____No_______________________

I. Introduction

This report presents the methods, findings, conclusions, and recommendations of the third five-year review for the Lemberger Landfill (previously called Lemberger Flyash Landfill) site (LL) and the Lemberger Transport and Recycling site (LTR), both of which are located in Franklin Township, Manitowoc County, Wisconsin (Exhibit 1). This is the third five-year review for LL and LTR. The report for these two sites is combined because the groundwater contamination from the two sites cannot be clearly distinguished. The purpose of this review is to evaluate implementation and performance of the remedial actions in order to determine whether or not the remedy is or will be protective of human health and the environment. The remedial action for the Site is expected to result in hazardous substances remaining above concentrations that allow unlimited use / unlimited exposure (UU/UE) at the end of the remedial action. Therefore, a five-year review is required by statute.[1]

This report was prepared by Region 5 of the U. S. Environmental Protection Agency (EPA). This five-year review relied upon reports and evaluations performed by the following parties:

- Luanne Vanderpool, Ph.D., Geologist, EPA;
- Andrew Podowski, Ph.D., Toxicologist, EPA;
- David Dougherty, Ph.D., Groundwater Engineer, Subterranean Research, an EPA contractor;
- Sheri L. Bianchin, IC Coordinator, EPA;
- James Walden, Hydrogeologist, Wisconsin Department of Natural Resources;
- Annette Weissbach, Hydrogeologist, WDNR;
- Gary Edelstein, Professional Engineer, WDNR;
- RMT, Inc. (RMT), a consultant for the Lemberger Site Remediation Group (LSRG), which represents a group of companies responsible for performance of the cleanup pursuant to the 1992 Consent Decree with EPA and WDNR;
- Douglas B. Clark, Attorney, Foley & Lardner, LLP, on behalf of the LSRG.

The following outside parties reviewed and provided comments on this report prior to its completion: David Dougherty, Ph.D; Annette Weissbach and Gary Edelstein, WDNR; and LSRG.

The triggering action for completion of this review is the date of signature of the Second Five-Year Review Report, September 21, 2005. Work specifically on the third five-year review was initiated by the EPA Remedial Project Manager (RPM) on December 11,

1 Section 121(c) of the Comprehensive Environmental Response Compensation and Liability Act, 42 U.S.C. § 9621 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and Section 300.430(f)(4)(ii) of the National Contingency Plan, require periodic review (at least once every five years) for sites where hazardous substances, pollutants or contaminants will remain above levels that would allow UU/UE after completion of the remedial action.

2009, but oversight and evaluation of the remedial actions has been an ongoing process during the last five years. This oversight and evaluation has included: preparation of operation and monitoring reports, and special demonstration projects by RMT; preparation of an Institutional Control (IC) study by Douglas Clark; preparation of reports evaluating remedial options by RMT; EPA and WDNR review of these reports; and inspections by EPA and WDNR. This report will be placed in the Administrative Record file located at EPA's office at 77 W. Jackson Boulevard, Chicago, Illinois, and in the local document repositories, which are located in the Whitelaw Village Hall, 147 W. Menasha Road and in the Manitowoc Public Library, 707 Quay Street.

II. Site Chronology

Table 1: Chronology of Site Events

Event	Date
LL used as township dump	1940 – 1969
LL operated as a licensed sanitary landfill	1969 – 1976
LTR operated as a licensed industrial waste disposal facility	1970 - 1976
Citizen complaints of leachate releases at LL	1980
EPA added LTR to Superfund National Priorities List	September 1984
Citizen complaints regarding drinking water, WDNR sampled nearby residential wells, and replaced seven wells with much deeper wells	1985
EPA added LL to Superfund National Priorities List	June 1986
EPA conducted Remedial Investigation/Feasibility Study (RI/FS)	1988 - 1992
EPA signed a Record of Decision (ROD) for LL source area containment (capping, slurry wall and leachate withdrawal) and LL and LTR groundwater cleanup by pump-and-treat (Operable Unit #1)	September 23, 1991
Consent decree requiring the LSRG to implement Operable Unit #1 was entered in court	October 22, 1992
EPA issued Administrative Order by Consent requiring the LSRG to implement containment, treatment, and waste removal at LTR source area (Operable Unit #2)	July 1993
EPA issued Preliminary Closeout Report for LL EPA issued Preliminary Closeout Report for LTR	September 9, 1996 October 22, 1996
LSRG initiated groundwater pump-and-treat, and leachate withdrawal	March 1997
EPA issued first *Five-Year Review Report*	September 27, 2000
LSRG initiated operation of expanded pump-and-treat adding four additional pumping wells to contain the LTR source area groundwater	December 2001
EPA issued second *Five-Year Review Report*	September 21, 2005

Table 1: Chronology of Site Events

Event	Date
With EPA approval, LSRG temporarily ceased groundwater pump-and-treat to conduct a monitored natural attenuation (MNA) study and evaluate the effectiveness of pump-and-treat	August 2006
With EPA approval, LSRG temporarily ceased leachate withdrawal at LL to perform leachate head demonstration project	December 2008
LSRG submitted draft *Monitored Natural Attenuation Engineering Demonstration Project* (MNA Report)	December 2008
EPA, WDNR and LSRG evaluate relative effectiveness of MNA, pump-and-treat, and other technologies	December 2008 – present
LSRG submitted report recommending permanent cessation of leachate withdrawal at LL subject to continued monitoring and a contingency to reinitiate	February 2010

III. Background

Physical Characteristics: The LL fence encloses approximately 40 acres of land, of which 21 were used for disposal (see Exhibit 2). The LTR fence also encloses approximately 40 acres, of which 16 were used for disposal (see Exhibit 3). The terrain of the general area is rolling to hilly with numerous wetlands. According to the RI, there are wetlands within 100 feet of LL. The terrain generally slopes to the west and northwest. The Branch River, which drains into Lake Michigan, is located about 3,000 feet west of LL and 3,500 feet northwest of LTR.

LL and LTR are geologically located within an interlobate glacial geomorphology characterized by alternating and random sequences and deposits of sand, gravel, and clay soils. Near LL and LTR there are two distinct sand and gravel deposits referred to as the upper granular unit and the lower granular unit, UGU and LGU repectively, which are generally separated by a clay unit. Below the LGU lies Niagara Formation dolomitic limestone bedrock, which is described as grayish-white massive to thinly bedded sedimentary rock with highly weathered surfaces.

There are two groundwater systems of concern at LL and LTR, a localized perched system called the upper groundwater system (UGS), and a more regional unit called the lower groundwater system (LGS) (see attached cross section, Exhibit 4). The UGS refers to perched groundwater lying atop a clay layer above the LGU. The UGS is may be a single interconnected aquifer or may comprise several discontinuous perched zones. The UGS also is present above the bedrock with no intervening clay layer at the southeastern corner of LL and north side of LTR and within bedrock along the eastern side of LTR. Recent mapping of groundwater heads in the UGS in the vicinity of the site indicates flows are to the west with some convergence toward the southwest corner of LL (see Exhibit 5).

The LGS consists of the upper bedrock and saturated portions of the overlying dense sandy gravel and gravely sand of the LGU. LTR is located on the flank of a bedrock ridge (see Exhibit 6), which reaches the surface just a few hundred feet south and east of LTR and slopes downward to the northwest. As a result, the LGU is not saturated in the vicinity of LTR and the eastern side of LL. The top of the water table is in the LGU starting 0.2 mile northwest of LTR, and on the western side of LL. The top of the LGS water table occurs from 10 to 40 feet below the top of the bedrock in the vicinity of LTR. As is generally the case, the upper part of the bedrock is more weathered and fractured, and fracture frequency decreases with depth. As a result, the permeability of the LGS is relatively low at and near LTR. However, horizontal and vertical fractures are present and provide significant migration pathways.

Contaminated groundwater from LTR migrates to the north and northwest through preferential pathways in the bedrock. In most RI borings, fractured and massive bedrock zones were found to be interlayered. The bedrock groundwater migrates into the LGU in the general vicinity of LL as the top of bedrock slopes downward north of LTR. At RM-208D the water table in the LGS is about 10 feet above the top of bedrock. From RM-208D to the monitoring wells near the Branch River, the contaminated groundwater in the LGS migrates to the north and northwest in the relatively permeable lower granular unit and upper bedrock (see Exhibit 7).

Land and Resource Use: LL and LTR are located in a lightly populated rural area, and in the vicinity of the Ridgeview Landfill (see Exhibits). Ridgeview Landfill is currently operating and is permitted to accept non-hazardous municipal, commercial and general industrial waste. LL and LTR are only about 1000 feet apart. Other land in the vicinity is generally undeveloped, is used for agriculture, or for widely spaced rural residences. Some land has also been used for rock quarrying and rubble disposal. All residences in the area rely on groundwater for drinking and other residential uses (see private wells existing at the time of the RI in Exhibit 9). The RI reported that the Niagara dolomite aquifer serves as the primary drinking water source in the area, and that 2,700 people used this aquifer for drinking within a three mile area of LL and LTR. As described in the Initial Response section, most of the residential wells found to be affected by LL and/or LTR contamination in 1985 were screened near the top of the dolomite rock and were replaced with wells screened starting at about 250 feet bgs.

The Branch River is used for fishing, canoeing and water supply. It is designated as Exceptional Resource Water, as defined by Wisconsin NR 102.11, is protected as a Great Lake aquatic community, is noted for its annual steelhead trout spawning runs and is a managed smallmouth bass stream.

History of Contamination: LL was used as a township open dump from 1940 to 1969. Part of LL was excavated as gravel quarry prior to 1951. Prior to being used for waste disposal, part of LTR was used as a gravel pit. In 1969, WDNR licensed LL as a sanitary landfill and LTR for industrial waste disposal. Waste disposal in LL was supposed to be limited to municipal waste and power plant fly and bottom ash. Industrial waste should have been diverted to LTR. LL and LTR were closed in 1976.

LL included no leachate collection. Operators were required to place soil over the wastes daily. WDNR requirements provided that after closure LL should have been covered with two feet of compacted soil, adequately sloped, and vegetated. Inspection reports for LL state that fly ash and bottom ash were used for daily cover instead of being buried with other wastes. It was also reported that fly ash was used to help bring LL to final grade. Subsequent investigations found that waste is up to 23 feet thick at LL. The estimated total volume is 479,000 cubic yards, but the quantity of hazardous or toxic wastes disposed in LL is unknown. Much of the waste disposed at LL was within the UGS, and above the clay layer, which separates the UGS from the LGS. However, during construction of the slurry wall, bedrock was encountered above the clay layer in the northeast corner of LL; so the clay layer was not continuous below LL.

At LTR, wastes were deposited in trenches excavated to a depth of about five feet. The documented waste volume and types from disposal records is summarized in Exhibit 10. The documented total quantity of waste disposed is about 870,000 gallons. Most of the waste (55%) was categorized as wood tar distillates, while 35% was aluminum dust, 5.5% were oil-water mixtures and 1.8% was paint waste. In 1976, the manufacturer described the wood tar distillates as follows: a polymerized material formed from the reaction of aldehydes of wood smoke with phenolic compounds from pyrolized wood lignin; a black, viscous, insoluble in water, partially soluble in vegetable oil and organic solvents, and completely soluble in acetone; and including 160 mg/ml substituted phenols and 400 mg/ml of carbonyls. According to an evaluation by RMT, the parent compounds of the major groundwater contaminants (TCA, tetrachloroethylene (or perchlorethylene (PCE), and TCE) were most likely from degreasing operations and were described as oil-water mixtures. Oil-water mixtures were likely to contain 50 to 65% spent solvents. Therefore, the 47,760 gallons of oil-water mixtures, likely contained about 30,000 gallons of solvent. RMT hypothesized that the LTR site operators preferred to dump liquids into trenches where the liquids would tend to infiltrate rapidly into the underlying soil or bedrock, i.e., where the surficial clay layer had been breached (*Assessment of Remedial Action Effectiveness*, RMT, June 2004, p. 9). During RI activities, it was found that solid wastes and drums of wastes were intermixed with fill material.

Initial Response: At LL, after discontinuation of operations, a 1 to 4 foot thick soil cover was installed that consisted of various types of soil. At LTR, one foot of clay soil was placed over the waste disposal areas. Although more cover was placed over waste in the early 1980s, wastes were still observed on the surface of LTR in the early 1990s.

In 1980, local residents located west of LL complained that leachate was seeping onto their properties. In response to these complaints, WDNR ordered the site owners to conduct an investigation. However, in 1983 a bankruptcy petition resulted in termination of investigation activities. Subsequently, WDNR recommended that LL and LTR be added to the National Priorities List.

In 1985, in response to complaints, WDNR sampled 43 residential wells in the area. Chlorinated VOCs (CVOCs), which are now known to be associated with LL and/or LTR were detected in seven residential wells (Exhibit 8). From 1985 to 1987, these seven residential wells were abandoned and replaced through Wisconsin's Well Compensation Program. The replacement wells were cased to about 250 feet bgs (see casing depths in Exhibit 9). EPA conducted an RI/FS from 1988 to 1991.

Basis for Taking Action: The first phase of RI sampling was performed from 1988 to 1990 and included sampling and analysis of samples of: surface soils on LL and LTR; soil borings; sediments and surface water from areas that receive drainage directly from LL; leachate seeps from LL; the UGS near LL; the LGS down-gradient from LL and LTR; and residential wells (see *Final Remedial Investigation Report*, B&V Waste Science and Technology Corp, January 18, 1991). Samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and cyanide. Soil boring samples were characterized by soil type, and physical tests, including hydraulic conductivity were performed. In-situ hydraulic conductivity tests were conducted at almost all monitoring wells. Because there was a site cover over LL, air sampling was not conducted.

EPA decided that no action was required under CERCLA for Ridgeview Landfill because only trace concentrations of VOCs were detected in the UGS down-gradient from the Ridgeview Landfill. EPA decided that no action was required to address sediments or surface water because RI data indicated that only background concentrations of contaminants were detected. EPA decided that no emergency action was required to address residential usage of groundwater because VOC concentrations were less than drinking water standards. For LL surface soils, EPA decided that no emergency action was required because RI data indicated that there was no significant current risk from exposure to surface soils on LL from trespassing, farming, or hunting.

The following contaminants were detected in LTR surface soils: VOCs ranging from 230 to 2000 ug/kg; SVOCs ranging from 94 to 2000 ug/kg; aldrin at 240 ug/kg; and dieldrin at 200 ug/kg. High concentrations of VOCs were detected in groundwater within the UGS below LL, including: acetone (14,000 ug/l); 2-butanone (21,000 ug/l); 1,1-dichloroethane (DCA, 320 ug/l); 1,1-dichloroethylene (1,1-DCE, 110 ug/l); total 1,2-dichloroethylene (1,2-DCE, 4,000 ug/l); 4-methyl-2-pentanone (2,400 ug/l); methylene chloride (5,000 ug/l); PCE (200 ug/l); toluene (400 ug/l); and xylene (480 ug/l). In addition, the following inorganic compounds were detected exceeding their Maximum Contaminant Level (MCLs), Wisconsin Enforcement Standards (ESs), Preventive Action Limits (PALs) and or risk based cleanup level: arsenic (10.9 ug/l); barium (1,910 ug/l);

cadmium (14.9 ug/l); and manganese (Mn, 3,280 ug/l). According to the RI, this contamination was likely to migrate off-site to the west in the UGS, and recharge adjacent wetlands. The confining unit appeared to be continuous below LL; so it was believed that contamination was very unlikely to migrate through the confining unit into the LGS. However, the RI noted that it is possible that low level detection of 2-butanone in MW-11 indicated that some migration through the confining layer was occurring. High concentrations of VOCs were detected in the LGS especially near LTR, including: detections exceeding 1000 ug/l of chloroethane, methylene chloride, DCA, 1,2-DCE, and TCA; and detections exceeding 100 ug/l of 1,1-DCE, TCE, toluene and xylene. In addition, PCBs and eight pesticides were detected in the LGS near LTR.

Using data from the RI, EPA determined that there were unacceptable human health risks from exposure to contaminated soil and groundwater at LL and LTR. The unacceptable incremental risks that were calculated in the RI included:

- From exposure to LL surface soil in case of future residential development, a lifetime incremental cancer risk of 1×10^{-5} (1×10^{-5} from arsenic and 2×10^{-6} from benzo(a)pyrene) and a chronic health hazard for children ages 1 to 6 (index = 1.1);
- From exposure to LTR surface soil in case of future residential development, a lifetime incremental cancer risk of 2×10^{-5} and a chronic health hazard for children ages 1 to 6 (index = 3.3);
- From future residential usage of groundwater in the UGS near LL, a lifetime incremental cancer risk of 9×10^{-4} and a chronic health hazard for children ages 1 to 6 (index = 28.8);
- From future residential usage of groundwater from the LGS near LL, a lifetime incremental cancer risk of 3×10^{-4} and for children ages 1 to 6 a chronic health hazard (index = 1.5);
- From future residential usage of groundwater from the LGS near LTR, a lifetime incremental cancer risk of 3×10^{-4} and for children ages 1 to 6 a chronic health hazard (index = 30.8).

Because data gaps were identified regarding contaminant sources at LTR, it was decided to proceed with a ROD addressing the LL source area and the groundwater contamination, which became OU #1. Further investigation was performed at the LTR source area, which became OU #2. Sampling for the OU #2 RI was performed in 1992, and primarily included 12 samples from 13 test pits, and 33 samples from 18 soil borings. The test pits were located based on magnetic anomalies. The samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals.

The RI report for OU #2 included cross sections of the geology within LTR based on the soil borings, and previously installed monitoring wells (see *Lemberger Transport and Recycling Inc. Site Source Control Operable Unit Remedial Investigation Technical Memorandum*, B&V Waste Science and Technology Corp., May 10, 1991). These cross sections identified layers of fill, a UGU, a clay unit, and a LGU, all of which were generally unsaturated. It was observed that fill soils were intermixed with solid wastes and drums. At some locations a black tar-like material with a burnt-wood charcoal odor was observed. The RI delineated hot spots, which were areas containing buried drums, concentrated wastes, and high contamination.

Four drums were located from the test pits, and it was estimated that 500 drums were located near one magnetic anomaly. A hazardous liquid was found in two drums based on the following test results: flash point = 54 °F; pH = 4.5; high VOCs (2.3% 2-butanone, 4.9% 4-methyl-2-pentanone, 28% toluene, 2.2% ethylbenzene, and 14% xylenes), and high metals (in ug/l: 120 lead; 4.5 chromium; 4 barium; and 27 zinc). A sample of waste paint contained: 1800 to 530,000 ug/kg of toluene, ethylbenzene, xylenes, trichloroethylene (TCE), and 1,1-DCE; and 76,000 to 110,000 ug/kg of phenol, 2-methylphenol, 4-methylphenol and naphthalene. The highest contamination in fill soil was detected in the test pit samples, including:

- up to 380,000 ug/kg of summation of toluene, ethylbenzene and xylenes;
- 200 ug/kg of PCE;
- 320,000 ug/kg of 4-methyl-2-pentanone;
- 80 to 45,000 ug/kg of acetone or methylene chloride;
- up to 210,000 ug/kg of phenolic compounds;
- up to 100,000 ug/kg of polyaromatic hydrocarbons (PAHs);
- up to 38 ug/kg of pesticides; and
- up to 2000 ug/kg of PCBs.

Up to 5,900 ug/kg of methylene chloride, acetone, toluene, ethylbenzene, and xylene were detected in soils below the fill areas.

The waste types, generators, and volumes disposed at LTR were summarized in the RI (Exhibit 10).

Based on the data from the OU #2 RI and the lack of security, EPA determined that LTR presented a current risk to trespassers and nearby residents from the threat of fire and explosion and releases from leaking or exploding of drums (see July 15, 1993 Administrative Order by Consent).

IV. Remedial Actions

Remedy Selection: The 1991 ROD provides for:

- construction of a solid waste landfill cap over LL, construction of a slurry wall along the perimeter of LL, and withdrawal of leachate within the slurry wall, all to contain contamination at the LL source area;
- construction of a six-foot security fence around LL and the groundwater treatment facility;
- construction of a groundwater pump-and-treat system to clean-up contaminated groundwater from LL and LTR to the limits of the waste management boundaries,

which was defined as the edge of the slurry wall at LL;

- a contingency to provide an alternative water supply to any residential well owners, whose water supply is disrupted by the pumping;
- deed restrictions;
- monitoring; and
- wetlands investigation, and implementation of measures to prevent damage to wetlands and mitigating measures, if necessary.

The 1992 Consent Decree requires design and implementation of the remedy in accordance with the 1991 ROD.

The July 15, 1993 Administrative Order by Consent required the following actions to address the LTR source area:

- perform a land survey to better define the LTR boundaries;
- construct a fence around LTR;
- conduct a geophysical survey to delineate areas that could contain buried drums;
- dig into areas identified by the geophysical study and removal all drums encountered;
- dispose of excavated drums and their contents;
- use soil vapor extraction (SVE) to treat contaminated soil in hot spots identified in the RI; and
- construct a solid waste landfill cover over the waste areas in accordance with WAC NR 504.07.

EPA's 1994 "no further action" ROD provided for construction of a composite cover system over LTR. WDNR concurred with this ROD with the following conditions: if SVE was not effective, a hazardous waste composite cover utilizing a minimum 40-mil (1.02 mm) thick geomembrane would be constructed over LTR; and construction of an active gas/vapor extraction system to prevent the remaining VOCs from migrating to the groundwater and to protect the cover from gas/vapor damage.

More detailed requirements are listed below.

LL SOURCE CONTAINMENT AND ACCESS RESTRICTIONS: The 1991 ROD requires the cap to consist of from bottom to top:

- a grading layer (clearing and regrading the existing cover soil with the addition of borrow soil as needed);
- a compacted clay layer;
- a geotextile if necessary to prevent clogging of the drainage layer;
- a drainage layer;
- compacted native soil layer;
- topsoil and vegetation.

In addition, the cap / gas control system is required to meet the minimum design requirements of Wisconsin Administrative Code (WAC) NR 504.07 (1) – (7), including:

- the compacted clay layer must be at least two feet thick, have a hydraulic conductivity of less than 1 X 10^{-7} cm/sec, and be placed in 6 in lifts;

- the drainage layer must minimize hydraulic pressure on the compacted clay layer, and must consist of a 6 in sand layer;
- the native soil layer must be a minimum of 2 feet thick;
- the top soil must be a minimum of 6 in thick;
- the vegetation must minimize erosion;
- construction of gas vent system, including an active gas collection system if necessary to achieve performance criteria in WAC NR 504.04(f); and
- a final slope of at least 3 to 5%, but not more than 25%.

Earthen drainage channels were to be located along the perimeter of the cap to collect surface water runoff and water from the drainage layer, and direct water to wetlands west of LL.

The 1991 ROD included the following requirements for construction of the slurry wall and performance of the leachate withdrawal:

- the slurry wall must be keyed into the clay layer between the UGS and LGS;
- a trench would be excavated and backfilled with a slurry of bentonite, water, and soil or cement to form a low hydraulic conductivity containment wall;
- the leachate withdrawal must result in an inward gradient at all points within and at the edges of the waste mass; and
- the leachate withdrawal must continue as long as contaminated groundwater within the slurry wall is generated.

Design documents required that the slurry wall extend three feet into the confining unit. The Section 4.4.6 of the *Final Operation and Maintenance Plan, Lemberger Landfill, RD/RA Operable Unit 1,* RMT, February 1997 (OMP) defined the compliance leachate head level to be one foot above the top of the clay confining unit. The OMP also provided that leachate would be collected into a holding tank and transported to the Heart of the Valley Wastewater Treatment Facility, Kaukauna, Wisconsin for treatment/disposed.

In addition to requirements in the 1991 ROD, the 1992 Consent Decree includes the following requirements relative to the LL fence:

- LL must be completely fenced in order to prevent access and vandalism to remedy components;
- the fence must be chainlink;
- warning signs are required every 200 feet advising that the area is hazardous due to chemicals in soil and groundwater, and providing a telephone number.

GROUNDWATER CLEANUP: The 1991 ROD includes the following descriptions of the LL and LTR pump-and-treat system used for the evaluation of the alternatives in the FS: the system would consist of six groundwater pumping wells pumping at a rate of 210 gpm, and the estimated time to achieve groundwater performance standards was 16 years. The FS proposed one source control pumping well and shallow groundwater collection sumps near LTR to provide hydraulic containment and removal of dissolved contaminants near LTR in order to prevent further migration of contaminants beyond the LTR northern boundary (*Assessment*, pp. 17–18). The ROD provides that the groundwater pumping wells must be installed and operated in accordance with WAC NR 112, and the effluent to the Branch River must meet the substantive requirements the Wisconsin Discharge Elimination System. The Consent Decree SOW defines some details regarding derivation of the discharge standards, for background surface water sampling, and assessment of habitat conditions for use in development of effluent discharge limitations. The SOW requires that the groundwater treatment technology demonstrate that it can prevent whole effluent toxicity, and defines acute toxicity testing requirements.

In the FS, it was estimated that the groundwater treatment would generate about seven cubic yards of sludge every month. The sludge was to be temporarily stored in 55 gallon drums. Off-site disposal of treatment residuals is required to meet federal and Wisconsin regulations, the Resource Conservation and Recovery Act, and EPA's off-site policy. It was noted that if the sludge contains detectable organic contaminants, it must be managed as a listed hazardous waste. Paragraph 15 of the 1992 Consent Decree requires written notification to appropriate state environmental official in the receiving state, WDNR's project coordinator, and EPA's RPM, prior to any shipment of waste material to an out-of-state facility, when the total volume of all such shipments exceeds 10 cubic yards.

The 1991 ROD includes the following groundwater cleanup standards to be achieved at the end of the cleanup action at the down-gradient edge of the waste management boundaries:

- MCLs, ESs, and PALs (see Exhibit 11);
- cumulative risks from residential usage from 1 X 10^{-4} to 1 X 10^{-6};
- for contaminants that do not have an MCL, ES or PAL, but do have toxicity factors, a calculated risk from residential usage of 1 X 10^{-6} for carcinogenic affects, and less than a hazard index of 1.0 for non-carcinogenic affects.

In the ROD, EPA explained that WAC NR140.2 provides an exemption from certain PALs and establishment of Wisconsin alternative concentration limits for specific contaminants if it is determined that it is not technically and economically feasible to achieve these PALs. The alternative concentration limits cannot exceed the greater of the ES or background concentrations. EPA also explained that it is possible that operating data would indicate that achievement of the groundwater cleanup standards is impracticable, in which case the remedy could be reevaluated.

Paragraphs 13.b and 13.c and the SOW of the 1992 Consent Decree provide details regarding submission of petitions for complete or partial shut-down of the groundwater pump-and-treat system, and of petitions for exemption from one or more groundwater cleanup standards. Paragraph 13.b requires continuous operation of the pump-and-treat system until a complete or partial shut-down petition is approved by EPA, in consultation with WDNR. Each shut-down petition shall include an evaluation of groundwater data from the previous 36 months. EPA may grant the shut-down petition if EPA agrees that there had been no statistically significant and verified exceedances of the groundwater cleanup standards (or alternative standards approved pursuant to a WAC NR 140.28, or a technical impracticability waiver pursuant to Section 121(D)(4)(c) of the Comprehensive Environmental Response Compensation and Liability Act). In the 2006 Explanation of Significant Differences (ESD), EPA approved a temporary shut-down of the pump-and-treat system in order to perform a two-year MNA study.

Paragraph 13.c of the Consent Decree provides that petitions for exemption from one or more groundwater cleanup standards may be submitted only after a period of at least seven years of full and proper operation of the pump-and-treat system, and identifies some requirements for the content of these petitions, including an evaluation of improvements to the design and, operation and maintenance of the pump-and-treat system. The SOW provides that the five-year reviews will include an assessment of whether groundwater contaminants are being attenuated at a reasonable rate.

The 2006 ESD permitted a pilot study for "temporary shut-down of the pump-and-treat system to study the effectiveness of continued operation without pumping and to study whether 'natural attenuation processes' exist at the site which might address the remaining groundwater contamination." The ESD did not "alter the scope of the remedy selected in the September 1991 and September 1994 RODs." The study was expected to last about two years. EPA's decision was largely based on RMT's evaluation, including RMT's groundwater modeling results.

MONITORING: The 1991 ROD requires: sampling of selected residential wells; hydraulic monitoring to verify hydraulic performance of the groundwater pumping, including determining of the extent of the cones of depression around the pumping wells; and compliance with WAC NR 141 for installation of groundwater monitoring wells.

The SOW requires groundwater monitoring to achieve the following three objectives: 1) monitor the pace of cleanup; 2) monitor the extent of contamination; and 3) assure health protection of residents using groundwater from nearby wells. The SOW requires that the monitoring network meet the objectives and be in compliance with NR 140 and NR508.20(11).

Paragraph 22 of the 1992 Consent Decree requires that sampling and analyses comply with EPA guidance on quality assurance, which includes a requirement to submit a Quality Assurance Project Plan (QAPP) for approval by EPA prior to any monitoring. The SOW outlines the contents of a QAPP. All sampling and analyses should be in accordance with the approved QAPP. The 2006 ESD added monitoring for MNA parameters during the two-year study, including dissolved oxygen (DO), carbon dioxide (CO_2), nitrate (NO_3), sulfate (SO_4), iron (Fe II), alkalinity, methane, chloride, manganese (Mn) and oxidation/reduction potential (ORP).

The 1991 ROD requires conducting a wetland investigation to determine the extent of wetlands on LL and the potential impact of pumping the UGS. Measures are to be implemented to avoid or minimize damage to the wetlands, in accordance with WAC NR 1.95 and NR 103. If damage to wetlands occur, then the impacts were to be mitigated. Actions must be in compliance with Executive Order 11990 and Wisconsin regulation.

Remedy Implementation:
CONSENT DECREES: In October 1992, the LSRG entered into a Consent Decree with EPA and WDNR to implement EPA's selected remedy for OU #1. In June 1993, the LSRG agreed to implement source control measures at LTR under an Administrative Order by Consent, which became effective on July 15, 1993.

LTR DRUM REMOVAL: In September 1993, Geosphere Midwest performed an electromagnetic induction survey at LTR. The survey was designed to be able to distinguish a single 55 gallon barrel from background, with the intension that all anomalies equal or greater than what could be caused by a 55 gallon barrel would be investigated. 134 significant anomalies were identified. By November 1993, a six foot chain link fence had been constructed along the LTR perimeter. From November 1993 to November 1994, Westinghouse Remediation Services performed the drum removal. This included exploratory excavations at the 134 anomalies, and waste excavation, staging, testing, classification, bulking if applicable, and transportation off-site. A total of 1380 drums, 180 lab jars, and 226 gas cylinders were excavated and disposed off-site (except that some of the empty gas cylinders were allowed to be disposed below the LTR site cover). Pentachlorophenol was detected in a number of the waste samples, and some waste samples were ignitable. In November 1994, a soil gas survey and pilot study for SVE were performed at LTR. The pilot study demonstrated that SVE is not a viable technology at LTR.

DESIGN AND CONSTRUCTION: Design of the OU #1 remedy was completed in March 1995. The pump-and-treat system design included of six pumping wells in the LGS, four screened in bedrock and two in the LGU. These six wells were intended to capture all of the contaminated groundwater in the LGS from LL and LTR. Exhibits 12 and 13 illustrate the intended capture zones in the bedrock and LGU, respectively, that were predicted using a groundwater flow model. The design pumping rates are shown in Exhibit 14. As shown in Exhibit 12, the purpose of EW-1D was to remove the most heavily contaminated groundwater and provide control of the LTR source area. EW-2D was apparently placed to provide backup source control. EW-3D, EW-4D and EW-5D were to control and contain the down-gradient or perimeter contaminant plume.

Pumping tests indicated that the design pumping rates were achievable except at EW-1D which was much less productive. In the OMP the target pumping rate for EW-1D was reduced from 25 gpm to 10 gpm. In the OMP, the purpose of EW-1D and EW-2D was described to be for hot spot removal.

The OMP included the following criteria for identifying the need for well maintenance:

- for sump wells, reduced performance along with more than a one foot difference in water level between operation and shut-down; and
- for pumping wells a 10% reduction in specific capacity.

If any wells require repairs or replacement, EPA and WDNR, was required to be notified in writing within 10 days of discovery of the damage, and repairs completed within 60 days of discovery of the damage.

An air stripping system was constructed to treat the extracted groundwater. The system consisted of three air stripping trains, each including two multi-stage air stripping units in series. The air stripping units are designed for an untreated water flow of from 50 to 100 gpm. The system was designed for a removal efficiency exceeding 97% for TCA, 89% for DCA, and 93% for TCE. Emissions from the stripping system are discharged to the ambient air without treatment.

The site cover for LL was equivalent to the design for the LTR site cover, which is described below, except that a geomembrane was not installed below the compacted clay. Construction for Operable Unit #1 started in July 1995.

Design of the Operable Unit #2 LTR site cover was completed in October 1995, and construction started in May 1996. The final design provided for construction of a composite site cover over LTR, including the following layers from bottom to top:

- regrading to provide a 2% minimum slope;
- a 12 in gas control layer with passive gas vents;
- a 24 in compacted clay layer;
- a synthetic geomembrane layer;
- 30 in of general fill;
- 6 in of top soil and vegetation.

EPA issued a preliminary closeout report for LL on September 9, 1996 stating that all construction activities were complete and consistent with the ROD and remedial design plans and specifications. The construction included:

- a solid waste cap over LL;
- a slurry wall surrounding the waste;
- eight leachate wells through the LL site cover to remove groundwater contained within the slurry wall and cap;
- one sump (GWC-6S) to remove groundwater from the UGS at the southwest corner of LL;

- three sumps to remove groundwater from the UGS on the west side of LTR (GWC-1, GWC-2, GWC-3);
- six groundwater pumping wells in LGS (two in the lower granular unit, EW-4I and EW-5I; and four in bedrock, EW-1D, EW-2D, EW-3D, EW-4D);
- a leachate storage system to hold leachate pumped from the LL leachate wells, and sumps;
- piping from the LL leachate wells and sump to the leachate storage system;
- a groundwater treatment system designed for an average design flow rate of 234 gpm, and a peak flow rate of 300 gpm.; and
- piping from the groundwater pumping wells to the groundwater treatment system.

According to the *Remedial Action Implementation Report, Lemberger Landfill Closure System and Ground Water Treatment System* (Malcolm Pirnie, April 1997), no clay layer was encountered before reaching top of bedrock in the northeast and southeast corners of LL, and in response to this changed condition, the slurry wall was terminated at the top of bedrock rather than being keyed 3 feet into the clay layer. It was anticipated that the LL leachate would be disposed at the Heart of the Valley Metropolitan Wastewater Treatment Plant. It was expected that the leachate would be pumped from the storage tanks to 6,000 gallon tank trucks three times per day and six days per week.

EPA issued a preliminary closeout report for LTR on October 22, 1996 stating that all construction activities were complete and consistent with the ROD, the Administrative Order by Consent, and remedial design plans and specifications. The construction activities included:

- the groundwater pumping wells and groundwater treatment components listed above are common with LL;
- a land survey to better define the boundaries of LTR;
- a six-foot chain-link fence around the area of potential contamination;
- a electromagnetic induction survey to delineate anomalies that could contain buried drums;
- excavation and off-site disposal of all containerized wastes located near the anomalies;
- a soil gas survey, and SVE pilot study, which demonstrated that implementation of SVE was not feasible;
- construction of a site cover exceeding the requirements of WAC NR 504.07.

In 2001, because the pump-and-treat system was not hydraulically containing the source area groundwater contamination, and apparently not resulting in progress towards cleanup of the groundwater contamination, RMT installed three additional pumping wells in the bedrock aquifer near LTR (EW-6D, EW-8D and EW-9D), and one in bedrock near the southwest corner of LL (EW-7D). In December 2001, RMT started the continuous pumping of these new wells, and discontinued pumping EW-5I, which was determined to be outside of the area of groundwater contamination.

System Operation, Maintenance and Monitoring

OPERATION AND MAINTENANCE PLAN: Malcolm Pirnie completed the following operation and maintenance plans in February 1997: *Final Operation and Maintenance Plan Lemberger Landfill, RD/RA Operable Unit #1*, and *Final Operation and Maintenance Plan Lemberger Transport and Recycling Site, Operable Unit #2* (jointly referred to as the OMP). The OMP included WDNR's final discharge limits, and an attached leachate disposal permit, but did not include ambient air discharge limitations from the groundwater treatment. The OMP defined procedures for operation, maintenance and monitoring of the LL and LTR remedial actions, including:

- semiannual inspections of the landfill cover, erosion control system, visible portions of the leachate wells, landfill gas vents, perimeter gas probes, and fence (in the Spring, and late summer);
- semiannual measurement of water elevations in leachate wells;
- inspection of pumping wells, monitoring wells and peizometers during each sampling round;
- at least annual mowing of the site cover;
- other maintenance and repairs as needed;
- health and safety procedures; and
- submission of semiannual progress reports where findings from the landfill cover inspections were to be documented on a checklist form.

The OMP included plans and an appended QAPP for all monitoring, including:

- quarterly groundwater sampling for VOCs and metals, and annual sampling for SVOCs, pesticides, PCBs, and cyanide at 43 monitoring wells screened in the UGS and LGS;
- semiannual groundwater sampling for VOCs, and metals, and semiannual sampling for SVOCs, pesticides, PCBs and cyanide at seven LGS monitoring wells;
- annual groundwater sampling for metals at background well;
- quarterly sampling for VOCs, SVOCs, metals, pesticides, PCBs, and cyanide at the pumping wells, four sumps, and the influent to the treatment system;
- quarterly sampling for VOCs at eight private wells and annual sampling for VOCs at 15 private wells;
- annual landfill gas sampling at 36 LTR gas vents for gas velocity, percent lower explosive limit, and an indicator of total non-methane VOCs (using a photoionization detector or equivalent. Vent emissions would be sampled for specific VOCs if there is a positive gas pressure and the indicator of total non-methane VOCs is greater than zero);
- annual soil gas sampling at six soil gas probes near the perimeter of LTR, and six near the perimeter of LL for percent lower explosive limit, and in an indicator of total non-methane VOCs to monitor for off-site migration of landfill gas in the vadose zone;
- effluent sampling; and

- Branch River sampling.

There were no provisions for monitoring air emissions from the groundwater treatment system.

In 2004, a reduced sampling schedule was approved varying from quarterly to annually for VOCs depending upon the well, annual sampling for metals, five year interval sampling for SVOCs, pesticides, PCBs, and continued quarterly or annual sampling of residential wells for VOCs. In August 2004, EPA approved an addendum to the QAPP updating procedures for analysis of metals.

PRIVATE WELL MONITORING RESULTS: According to the 2000 *Five-Year Review Report*, private well GR-60 was replaced with a deeper well (GR-60R) during remedial design activities because of contamination from LTR. During this period, TCA and DCA were consistently detected at GR-13 and GR-41 at concentrations below the ESs.

LANDFILL GAS MONITORING RESULTS: For LL, apparently during the design process, it was determined that the landfill gas emissions from LL would not be significant, and, therefore, the OMP did not provide for monitoring these vents. Six soil gas probes were installed outside of the site cover to monitor for off-site migration of soil gas. Soil gas samples were collected from these probes quarterly from 1997 to 1999, and semiannually from 2000 to 2001. No significant concentrations of methane or total VOCs were detected. At LTR, the 36 gas vents and six perimeter soil gas probes were installed and monitored quarterly from 1997 to 1999, and semiannually from 2000 to 2003. No significant levels of methane or total VOCs were detected. These results indicate that there were no significant landfill gas emissions at LL or LTR and, therefore, no significant risk to off-site residents from these emissions.

LL CAP, SLURRY WALL, LEACHATE WITHDRAWAL: At RM-208S and RM-207S, which are screened in the UGS and located just down-gradient from the LL slurry wall (see Exhibit 15), concentrations of VOCs decreased to less than the PALs shortly after construction of the slurry wall and start of pumping. UGS VOC concentrations at RM-103S and RM-5S gradually decreased to below the PALs. By 2003, the limited VOC detections in the UGS outside of the LL slurry wall were below PALs. LGS data for the major VOCs of concern did not identify an impact by LL. VOC concentrations in the LGS upgradient from LL (RM-8D) exceeds concentrations down-gradient from LL (RM-5D and RM-103D), which indicates that LTR is the predominant source of VOC contamination in the LGS.

The 2000 and 2005 Five-Year Review Reports identified no problems with maintenance of the LL site cover, but there has been an ongoing concern about the reduction in leachate head levels. After start of leachate withdrawal within the slurry wall at LL, leachate heads decreased, but at a much slower rate than expected. In 1999, WDNR reviewers expressed concern that the LL leachate could be a continuing source of VOC contamination to the LGS by migrating through the confining clay layer, or through bedrock or sand where the confining clay layer is absent. WDNR recommended that the rate of leachate pumping be increased. According to the 2000 *Five-Year Review Report*, WDNR observed that the rate of leachate withdrawal had been reduced because of downtimes. In response to this in September 2000, RMT submitted an addendum to the OMP providing a preventive maintenance program for the leachate withdrawal wells. RMT periodically had the leachate pumps pulled and the wells cleaned in accordance with this plan. Leachate withdrawal rates were restored (see Exhibit 16), and leachate heads continued to decrease.

By 2003, all nine of the leachate heads were below the bottom of the wastes. By 2004, the leachate head levels at LH-4, LH-5, LH-6, and M-14R were generally reduced to the target level of one-foot above the clay confining layer, and the heads in other leachate wells continued to trend downward except for LH-07, where the bottom of the well is four feet above the clay confining layer. It is observed that LH-06 and LH-07 head levels jump every spring coinciding with annual spring recharge occurrences, which indicates that the confining unit / slurry wall has not fully separated the LL leachate from the UGS outside of the slurry wall. LH-06 and LH-07 are near the southeast corner of LL where portions of the bottom of the slurry wall was on bedrock or sand instead of keying into the clay confining layer.

In 2000, RMT observed that VOC concentrations in the bulk LL leachate were relatively low, and, proposed to sample the leachate from the leachate head wells in order to better evaluate the potential for LL to contaminate the LGS. In July 2000, RMT sampled eight leachate head wells for VOCs and five for SVOCs and metals. High VOC concentrations were detected in two of the eight samples, including the following VOCs, which exceeded current ESs by more than ten times: 1,2-DCE (13,000 ug/l); 2-butanone (7,500 ug/l); benzene (75 ug/l); methylene chloride (9,600 ug/l); and vinyl chloride (900 ug/l). WDNR reported that 14 of the 21 organic compounds detected in the leachate wells had also been detected in the LGS, including: TCE (471 ug/l) and 1,1,1-trichloroethane (TCA, 380 ug/l). A number of ketones that were detected at high concentrations in the leachate, including: acetone (7,300 ug/l); 2-butanone; 2-hexanone (650 ug/l); and 4-methyl-2-pentanone at (1,500 ug/l). Ketones were also detected in 2003 in groundwater at RM-005D, which is adjacent to and directly down-gradient from LL, but were not detected in other monitoring wells. From this data it appeared that LL had a significant potential to cause groundwater contamination in the LGS, and that there was pathway for contaminant migration from LL to the LGS.

The relatively high concentrations of 1,2-DCE (probably mostly cis-1,2-dichloroethylene (Cis)), vinyl chloride, and DCA (1,200 ug/l) in the LL leachate samples compared to PCE, TCE and TCA appears to indicate that most of the parent CVOCs had biodegraded to lower chlorinated CVOCs. The only SVOCs and metals that exceeded ESs in the LL leachate were arsenic and lead.

GROUNDWATER PUMPING AND THE EXTENT OF GROUNDWATER CAPTURE: Table 2 presents pumping rate data calculated from data in RMT's April 23, 2010 letter.

Table 2: Pumping Rates from Source Control Wells April 1997 – September 2005 (in gpm, listed from first week to end week within time period)

TIME	EW-1D	EW-2D	EW-7D	EW-6D	EW-8D	EW-9D
Design rate	25	50	50[2]	25	25	25
4/97 – 7/97	7.9 – 7.2	52 – 52				
8/97 – 4/98	3.9 - NM[3]	52 – 51				
4/98 – 9/98	5.6 – 5.1	48 – 52				
10/98 – 6/99	4.9 - 3.0	52 – 50				
7/99 – 12/99	2.4 – 2.2	50 – 50				
1/00 – 8/00	2.0 – 0.5	50 – 50				
8/00 – 8/01	1.9 – 2.4	51 – 55				
8/01 – 10/01	1.9 – 1.2	55 – 54				
12/01 – 4/02	1.5 – 1.4	46 – 45	24 - 23	0.16 – 0.17	0.11 – 0.18	0.22 – 0.30
5/02 – 7/02	2.9 – 2.9	45 – 45	24 - 24	0.25 - 0.21	0.24 – 0.21	0.41 -- 0.27
8/02 – 12/02	2.9 – 1.4	45 – 45	24 - 24	0.22 – 0.18	0.19 – 0.17	0.26 -- 0.19
01/03 – 12/03	1.3 – 1.2	45 – 43	22 - 15	0.17 – 0.12	0.16 – 0.17	0.18 – 0.17
01/04 – 07/04	1.2 – 2.0	43 - 42	15 - 15	0.12 – 0.15	0.16 – 0.22	0.17 – 0.17
08/04 – 12/04	1.0 - 0.53	43 – 16	14 - 11	0.14 – 0.12	0.21 – 0.15	0.18 – 0.14
01/05 – 05/05	0.58 – 1.7	14 - 40	11 – 7.9	NM – 0.11	'NM – 0.15	NM – 0.15
06/05 – 09/05	1.7 – 0.29	43 – 41	8.9 - 6.4	0.12 - 0.05	0.15 – 0.12	0.15– 0.075

As can be seen from Table 2, the only source control well that has been pumped near the design rate was EW-2D. EW-1D was pumped at 7.9 to 7.2 gpm during its first four months of operation from April to July 1997. After a period of extended down-time, EW-1D was operated at 5.6 to 5.1 gpm for about five months. After this period the pumping rate gradually decreased to below 2 gpm. The reaming of EW-1D in December 2001[4] apparently resulted in no increase in pumping rate, although later in 2002 the pumping rate was increased to close to 3 gpm in May to July 2002. After that period, EW-1D pumping rates gradually decreased to below 1 gpm although there were periods when the rate increased. RMT has suggested that the pumping rates decreased at EW-1D because the fractures with which EW-1D may be connected have been drained of water and are slow to recharge. However, the historical water levels at the closest monitoring wells (RM-7D and RM-7XD) do not indicate any decrease in water levels (refer to Appendix C of the MNA Report).

The pumping rate from EW-7D was maintained at 22 to 24 gpm from December 2001 through February 2003, after which the rate gradually decreased. Pumping rates at

2 The original design rate for EW-7D was 100 gpm (RMT, "Project Description and Basis of Design, Groundwater Extraction System Improvements", Table 4, August 2001) but was later revised downward.

3 Not measured. Much of the time between 08/97 and 06/98, EW-01D was not pumping.

4 To restore the pumping rate at EW-1, the 6 inch open borehole was reamed using a 6-inch tri-cone drilling bit. During the reaming, compressed air and potable water were injected into the well under high pressure to remove chemical and biological fouling from the borehole wall. The pump was disassembled, cleaned, and checked. (RMT, *Project Description and Basis of Design, Groundwater Extraction System Improvements*, 2001).

EW-6D, EW-8D, and EW-9D were very low, and gradually decreased further.

In June 1999 RMT submitted the *Groundwater Monitoring Report and Plan for Recovery System Enhancements*, June 1999. This report was updated to address EPA and WDNR comments in September 2000. In this report, RMT concluded that the contaminant plume was narrower than depicted in the RI, and that the pump-and-treat system was not capturing the contaminant plume. A major concern was that the pumping was not capturing all groundwater contamination migrating from the LTR source area. As previously noted, the pumping rate from EW-1D was much less than both the 25 gpm design rate and the 10 gpm target rate (based on post-installation data). Pumping rates from down-gradient pumping wells (for example see data for EW-2D listed above) were near design rates. However, pumping at EW-2D was apparently not containing the LTR source area contamination in the bedrock aquifer as had been predicted by the model (see Exhibit 12) apparently because the bulk of the LTR contaminated groundwater migrates in a more northerly direction than had been represented in the groundwater flow model used in design. Neither the 1999 report nor progress reports mentioned any well maintenance performed to attempt to restore pumping rates at EW-1D, but design documents for adding wells EW-6D and EW-7D included a proposal to ream EW-1D in order to increase its pumping rate.

In the 1999 report, RMT explained that they performed a hydraulic analysis, which indicated that hydraulic conductivity is likely substantially greater deeper in the LGS, which could result in much increased pumping rates if a deeper pumping well were installed near EW-1D. However, because of concern that deeper pumping would draw contamination deeper into the LGS, RMT recommended installation a couple additional shallow bedrock pumping wells near the source area (EW-6D, and EW-7D), along with elimination of pumping EW-5I, reduced pumping from EW-2D, and rehabilitation of EW-1D. Because EW-6D was much less productive than expected, two additional bedrock wells were installed at the north boundary of LTR (EW-8D and EW-9D). EW-6D, EW-8D and EW-9D have 30 foot screens, the top of which is within 5 ft of the water table in the bedrock. EW-7D also has a 30 ft screen in the bedrock, but it is installed deeper than any other extraction well screens, with its top approximately 40 ft below the water table and 10 ft deeper in the bedrock. Continuous pumping of the new wells, restart of EW-1D, and discontinuation of pumping at EW-5I was initiated in December 2001.

Although the pumping rate of EW-1D remained low after the reaming, subsequent progress reports included no information on well maintenance to restore pumping rate. In addition, there was no attempt to perform hydraulic monitoring to determine the extent of the cones of depression around the pumping wells as provided for in the 1991 ROD. Note that the combined pumping rate from EW-1D, EW-6D, EW-8D, and EW-9D was much less than the rate that the 1999 model predicted could be pumped from a single well (25 gpm or more).[5] EW-7D was pumped at about 25 gpm, although aquifer testing had predicted that it would be possible to pump at 100 gpm. Meanwhile, pumping rates were near design rates in down-gradient pumping wells (EW-2D, EW-3D, EW-4I, and EW-4D).

In *Semiannual Progress Report 10* (July through December 2001), RMT estimated that the pump-and-treat system would remove about 60 pounds of VOCs per year, which was an estimated 59% increase in the mass removal rate compared to the pre-improvements system. RMT estimated that source area pumping wells (EW-1D, EW-6D, EW-7D, EW-8D, and EW-9D) would remove 31 lbs of VOCs per year, a 250% increase from the previous system. RMT estimated that TCE would be removed at a rate of about 4.1 lbs per year. In 2004, RMT estimated that the actual TCE removal rate was about 3.3 lbs per year. The low VOC levels in the sumps for the UGS groundwater contamination indicates that only minor amounts of VOCs were being removed via the sumps near LL and LTR.

LGS DATA: (The following is an interpretation from review of 1997 to 2003 groundwater data from *Proposed Revisions to the Groundwater Monitoring Program*, RMT, October 2003.)

Throughout 1997 to 2003, groundwater near LTR had elevated concentrations of TCA, DCA, 1,2-DCE, and TCE. With the following exceptions there were no noticeable trends in these CVOC concentrations in groundwater near LTR. Increasing trends (greater than a two fold increase of the average of the first three compared to the last three data points):

- RM-007XD: TCA (25 to 58 ug/l), DCA (8 to 26 ug/l), 1,1-DCE (3.5 to 9 ug/l); 1,2-DCE (14 to 59 ug/l); TCE (3 to 11 ug/l);
- RM-306D: TCE (3 to 9 ug/l);
- RM-307D: DCA (26 to 80 ug/l);

Decreasing trends (50% or greater decrease in average of first three compared to the last three data points):

- RM-303D: PCE (17 to 8 ug/l);
- RM-007D: vinyl chloride (620 ug/l to ND);
- RM-303D: vinyl chloride (420 ug/l to ND); and
- RM-005D: vinyl chloride (16 ug/l to ND).

The decreases in vinyl chloride occurred shortly after startup of the pump-and-treat system.

The high concentrations of DCA indicate that reductive dechlorination of TCA to DCA was occurring in the LTR source area. In later testing, which began with the MNA study, it was found that nearly all of the 1,2-DCE detection was Cis, which is the primary

5 This was the second time the groundwater model used for the original design was used to estimate pumping rates and the second time the bedrock well pumping rates near LTR were grossly overestimated. It is clear that the groundwater model was based on a flawed conceptual model, and corrections were needed before further use.

isomer formed from reductive dechlorination of PCE and TCE. Therefore, high concentrations of 1,2-DCE indicates that reductive dechlorination of PCE and TCE to Cis was occurring.

Little or no PCE, ketones, or BETX compounds (benzene, toluene, ethylbenzene or xylenes) were detected in the groundwater even near LTR, even though disposal information indicates that wastes contained these VOCs. Commonly BETX compounds biodegrade readily in groundwater under aerobic conditions, and that is probably their fate at LTR. Apparently, biodegradation of PCE is complete or nearly so at LTR, but biodegradation of TCA and TCE is arrested prior to depletion of the TCA and TCE. The high 1,2-DCE concentrations along with very little vinyl chloride indicates that conditions are not favorable for biodegradation from Cis to vinyl chloride. Detections and similar concentrations of TCA, TCE, DCA and 1,2-DCE in groundwater from RM-208D to RM-210D suggests that conditions are not favorable for biodegradation of these CVOCs in most of the down-gradient aquifer.

In down-gradient groundwater, the only increasing trend observed was at far down-gradient well, RM-203D, where TCA increased from 3.8 to 8.3 ug/l. The following decreasing trends (more than a 50% decrease) were observed at down-gradient LGS wells:

- RM-008D: DCA (44 to 15 ug/l);
- RM-208D: 1,2-DCE (9 to 4.5 ug/l);
- RM-208I: TCA (10 to 4 ug/l), DCA (5 to 1 ug/l);
- RM-103D: TCA (32 to 15 ug/l), DCA (13 to 6 ug/l), 1,2-DCE (10 to 4 ug/l);
- RM-204D: TCA (33 to 16 ug/l), DCA (19 to 7 ug/l), 1,1-DCE (6.5 to 1 ug/l), 1,2-DCE (8 to 3 ug/l);
- RM-204I: TCA (31 to 14 ug/l), DCA (15 to 5 ug/l), 1,2-DCE (4.1 to 2 ug/l);
- RM-003D: TCA (100 to 50 ug/l), DCA (54 to 13 ug/l), 1,1-DCE (9 to 1), 1,2-DCE (21 to 6 ug/l), TCE (10 to 3 ug/l);
- RM-003I: TCA (5 to 2.3 ug/l), DCA (3 to 1 ug/l);
- RM-211D: TCA (6 to 1 ug/l);
- RM-101D: TCA (23 to 9 ug/l), DCA (18 to 7 ug/l), 1,2-DCE (4.7 to 1.8 ug/l), TCE (5.4 to 2.7 ug/l);
- RM-002D: TCA (22 to 8 ug/l), DCA (18 to 2 ug/l), 1,1-DCE (2.7 to 0.5 ug/l), 1,2-DCE (12 to 1.8 ug/l), TCE (4 to 1.2 ug/l);
- RM-210I: DCA (15 to 7 ug/l), 1,1-DCE (2.4 to 0.6 ug/l), 1,2-DCE (9.3 to 4.2 ug/l).

Conceptually (assuming that in-situ degradation rates and migration from the source area are constant)[6], the concentration decreases at RM-008D and RM-208D could be

6 These are not unreasonable assumptions. Relatively constant CVOC concentrations in LTR source area monitoring and pumping wells indicate that migration of CVOCs from LTR has been relatively constant, and this is consistent with RMT's conceptual model of the LTR VOC source in *Assessment pp. 6-15*. The MNA data indicates that little reductive dechlorination occurs at or down-gradient from the LTR northern boundary. The relatively

attributed to partial capture of the LTR source area groundwater contamination by pumping LTR source area wells, EW-1D, EW-6D, EW-8D, and EW-9D and/or capture or redirection of contaminated groundwater by pumping EW-7D. Decreases at RM-208I, RM-103I, RM-103D, RM-204I, and RM-204D could be attributed to partial capture of LTR source area groundwater and/or containment of the LL source area. Decreases at RM-003D, RM003I, RM-211D, RM101D, RM-002D, and RM-210I are likely to be a result of diversion or capture of the contaminated groundwater from pumping EW-4D, EW-4I, and EW-2D.

Through 2003, the only SVOCs of concern were bis(2-ethylhexyl)phthalate (BEHP) and bis(2-chloroethyl)ether. BEHP was detected sporadically exceeding its ES (6 ug/l), and PAL (0.6 ug/l), but the detections do not appear to be related to LL or LTR. Bis(2-chloroethyl)ether was detected in four of nine samples from RM-208S exceeding the EPA Region 3 screening level (RSL) of 0.012 ug/l with a maximum detection of 7 ug/l. This contaminant was not detected in any other groundwater location.

In general, dissolved iron (Fe) and manganese (Mn) are low in the LGS, and relatively high in the UGS. Dissolved Fe was detected at up to 13,000 ug/l in the UGS near LTR (GWC-3), up to 24,000 ug/l in the UGS near LL (RM-207S), and at up to 1,300 ug/l in background UGS (RM-004S). Landfills typically generate anaerobic conditions and the wastes include articles containing Fe, which result in elevated Fe in the leachate. Therefore, LL and LTR probably contribute to the elevated Fe in the UGS. The difference in Fe concentrations between the UGS and LGS, could indicate that the UGS is relatively anaerobic and the LGS is relatively aerobic. An exception to the relatively low dissolved Fe and Mn in the LGS was detection of 3,700 ug/l of Fe at RM-005D. This detection is another indication that a migration pathway could exist from the UGS to the LGS at LL.

Metals were detected exceeding ESs in a number of samples from the UGS near LL and LTR.[7] However, the metals were not repeatedly detected. This groundwater also contained high Fe, and typically other metals are removed from the groundwater when the Fe precipitates. Antimony and thallium were detected exceeding the ESs in a number of samples, but were never consistently detected at the same well, and the distribution of detections does not appear to be related to LL or LTR.

The only metal repeatedly detected exceeding its ES in the LGS was nickel (ES = 100 ug/l). Nickel was consistently detected at RM-305D at the up-gradient boundary of LTR (100 to 1210 ug/l). Nickel was also detected at the down-gradient boundary of LTR (up to 860 ug/l at RM-007D). Nickel was elevated in background UGS (up to 700 ug/l at

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constant daughter / parent ratios from LTR to the far down-gradient plume area, indicates that little biodegradation is occurring in this area, and the CVOC concentration reductions are result of dilution.

7 Maximum detections of dissolved metals were: at EW-06S - arsenic 500 ug/l, barium 3,400, chromium 170 ug/l, lead 100 ug/l, nickel 110 ug/l, thallium 41 ug/l, and vanadium 290 ug/l; at RM-208S - arsenic 70 ug/l, selenium at 76 ug/l, and thallium at 13 ug/l; at RM-206S - nickel 103 ug/l;at RM-207S - arsenic 24 ug/l; at GWC-2 lead 29 ug/l; at RM-301S - cobalt 90 ug/l, nickel 4500 ug/l, thallium 6.4 ug/l; at RM-302S – thallium 4.9 ug/l.

RM-004S), and in the UGS near LL (up to 4,500 ug/l at RM-301S). However, nickel concentrations were not elevated at other LGS wells farther down-gradient from LTR.

There is little concern about cyanide, pesticides, or PCB contamination in groundwater based on the 2003 data summary. Out of 11 sample rounds, there were no detections of PCBs. There were four sporadic detections of pesticides exceeding RSLs in monitoring wells,[8]. There were detections exceeding the RSL for beta benzene hexachloride at EW-6 and EW-8.[9] Concentrations of cyanide much less than the ES were detected in 39 monitoring well samples, and were repeatedly detected only in the UGS near LL and at a background location. Out of 27 sampling rounds there were only 10 trace detections of cyanide at the pumping wells.

ASSESSMENT OF PUMP-AND-TREAT AND BEDROCK INVESTIGATION: In June 2004, RMT submitted *Assessment of Remedial Action Effectiveness*, which stated that the source area pumping wells (EW-1D, EW-6D, EW-7D, EW-8D, and EW-9D) were "not effective in intercepting and removing" the groundwater VOC contamination. RMT asserted that their groundwater modeling indicated the following: only 5% of the VOC mass entering the groundwater at LTR was being removed by the pumping; 90% was degrading in-situ; 5% was entering the Branch River; and the pump-and-treat as being operated would not shorten the time required to achieve groundwater cleanup standards. RMT's groundwater model was only slightly modified from the model used to design the expanded pumping system in 2000 (*Assessment,* p. 43). Model updates included use of actual pumping rates.

Based on this evaluation, on February 9, 2005 RMT submitted a letter to EPA and WDNR requesting EPA's approval to perform a full-scale demonstration project to evaluate natural attenuation processes. In the same letter, RMT reported that they were preparing a screening of technologies for removing, destroying, or containing the VOC source beneath LTR, including "potential methods for improving the effectiveness of hydraulic containment of the VOC plume as it emerges from beneath the LTR, as discussed at the meeting in November 2004." In an April 26, 2005 letter, EPA concluded that there was sufficient justification to perform the requested demonstration project, and indicated that a workplan for this project should be prepared and submitted to EPA and WDNR. RMT submitted the first draft of this workplan in August 2005.

RMT's February 9, 2005 letter also included a description of discussions during a November 2004 meeting with EPA and WDNR. During this meeting, WDNR raised concern that because the bedrock surface declines towards the northwest below LTR (see Exhibit 6), there appeared to be potential for dense non-aqueous phase liquid to

8 At RM-207S heptachlor was detected in one/eleven samples at 0.025 ug/l (RSL = 0.015 ug/l); at RM-208D aldrin was detected in one/eleven samples at 0.19 ug/l (RSL = 0.004 ug/l); at RM-208S beta-BHC was detected in one/nine samples at 0.055 ug/l RSL = 0.042 ug/l); and at RM-304D heptachlor epoxide was detected in one/eight samples at 0.0098 ug/l (RSL = 0.0074 ug/l).

9 Beta-BHC was detected in three/seven samples at EW-1D, EW-6D, EW-8D and EW-9D with maximum concentrations ranging from 0.022 ug/l at EW-1 to 0.072 ug/l at EW-6.

have migrated along the top of bedrock from LTR disposal areas toward the northern boundary of LTR. There was also discussion of the possible need for further characterization of the bedrock fracture network near LTR in order to better evaluate: improvements to the hydraulic containment of the VOC plume emanating from beneath LTR; knowledge of locations and distribution of VOC mass beneath LTR; and the feasibility of removing, destroying, or containing the VOC contamination beneath LTR.

In response to concerns expressed during the November 2004 meeting, in April 2005, RMT submitted *Workplan for Field Investigation of Bedrock Characteristics.* The purpose of this work was to obtain data on physical and textural properties of the dolomite bedrock, to test for free product near the perimeter of LTR, and to characterize the physical nature and distribution of VOCs in the bedrock near LTR. RMT proposed performing three borings near the northern boundary of LTR and running tests to characterize the geology and hydraulic conductivity, test for free product, and characterize the distribution of VOCs. In a May 18, 2005 letter, EPA requested additional borings down-gradient from LTR where the hydraulic conductivity is higher and pumping could be more effective in controlling the LTR source area groundwater contamination that was escaping the existing pump-and-treat system and migrating down-gradient. In a July 20, 2005 letter, EPA approved the *Addendum to the April 2005 Workplan for Field Investigation of Bedrock Characterisitics at the Lemberger Transport and Recycling (LTR) Landfill*, which provided for six borings, the three originally proposed by RMT, and three farther down-gradient (see locations of B-1, B-2, B-3, B-5, RM-213D, and RM-214D on Exhibit 17); fracture and hydraulic analysis; tests for presence of DNAPL; VOC analyses of groundwater and the bedrock matrix collected from discrete depth intervals within the boreholes. The bedrock investigations were conducted in August and September 2005, and some of the discrete depth interval groundwater sampling was repeated in March 2006.

Institutional Controls: Institutional controls (ICs) are non-engineered instruments, such as administrative and/or legal controls, that help minimize the potential for exposure to contamination and protect the integrity of the remedy. Compliance with ICs is required to assure long-term protectiveness for any areas which do not allow for unlimited use or unrestricted exposure (UU/UE).

The history and data for LL and LTR clearly indicate that UU/UE is not acceptable for the landfilled areas where potentially highly concentrated wastes remain under the site covers, and for the contaminated groundwater (see Exhibit 18). At this time, there is no expectation that the area of contaminated groundwater will contract in the near future. The RI data eliminated concern about impact of surface water run- off or groundwater recharge to adjacent properties. Landfill gas monitoring has indicated that there are no off-site risks from landfill gas emissions or migration in soil. An analysis by RMT indicates that there is no off-site risk from vapor intrusion from groundwater contamination.

Table 3 summarizes the media and areas that do not support UU/UE, prohibitions needed, and ICs that are in place.

Table 3: Institutional Controls Summary

Media & Areas that Do Not Support UU/UE Based on Current Conditions	IC Objective	Title of IC Instrument Implemented
Wastes, contaminated soils, groundwater in LL disposal area	Prevent: exposure to and disturbance of wastes and contaminated soils; interference with the remedy; and usage of groundwater	*Environmental Protection Easement and Declaration of Restrictive Covenant* , site owners and LSRG, Document 1065459, May 20, 2009, filed in Manitowoc County (attached) LSRG notification of and agreement with easement holders WAC NR 506.085 WAC NR 812
Wastes, contaminated soils, groundwater in LTR disposal area	Prevent: exposure to and disturbance of wastes and contaminated soils; interference with the remedy; and usage of groundwater	*Environmental Protection Easement and Declaration of Restrictive Covenant* (2), site owners and LSRG, Documents 1065459 and 1065460, May 20, 2009, filed in Manitowoc County (attached) LSRG notification of and agreement with easement holders WAC NR 506.085 WAC NR 812
Off-site groundwater contamination, see Figure 3	Prevent: usage of groundwater; and interference with the remedy (including diversion of the plume)	WAC NR 812

The IC instruments, plan, and long-term monitoring strategy are explained below.

Restrictive Covenants: The 1991 ROD requires that deed restrictions be used to restrict usage of the LL property, and noted that deed restrictions could be used to limit usage of contaminated groundwater. The 1992 Consent Decree SOW requires that the LSRG effectuate deed restrictions for all of the facility property that any of them own, and to use their best effort to effectuate deed restrictions on portions of the facility owned by other persons. The deed restrictions must prohibit development permanently, and prohibit installation of drinking water supplies until MCLs, ESs and PALs are achieved.

The two restrictive covenants dated May 20, 2009, Exhibits 19 and 20, utilize EPA's model language, including: adding WDNR and the United States as third party beneficiaries; prohibiting usage of the groundwater; prohibiting disturbance of the surface or subsurface of the land; an environmental protection easement; and a provision that all terms and conditions shall run with the land. These documents were recorded with the Manitowoc County Recorder. These agreements were between the LL and LTR property owners and LSRG and supplant previous agreements between these parties. In response to EPA's review, the LSRG is working with the property owner to correct a mistake in the property description for the LTR disposal area.

Notification and Agreement with Easement Holders: A utility easement exists within the fenced areas but outside of the wastes. The LSRG has informed EPA that they have notified the utility of the deed restrictions and presence of waste. A nearby village owns an easement for a road that includes some of the waste area. The LTRG has notified EPA that they have an agreement with the village to prevent them from contacting the waste.

WAC NR 506.085: In 1995, the State of Wisconsin issued new regulations, which regulate operation of landfills, and provides that WDNR approval is required to use waste disposal areas for agricultural purposes, to establish or construct any buildings, or to excavate the final cover or any waste materials (see NR 506.085, and p. 3 of IC plan). In effect, without WDNR approval, this regulation prohibits disturbance or use of the site covers and wastes at LL and LTR.

WAC NR 812: In 1988, the State of Wisconsin identified a Special Well Casing Depth Area SWCDA) in the vicinity of the Lemberger sites to regulate installation of water supply wells that could become contaminated from these sites. In 1991, the State of Wisconsin issued new groundwater usage restrictions (WAC NR 812), which, among other provisions, requires a WDNR variance before any well is constructed or reconstructed within 1200 feet of a landfill site. For LL and LTR, the 1200 ft area is shown by the dark dashed line on Exhibit 18. According to the SWCDA, outside the 1200 ft limit, but within the area with the dark diagonal lines on Exhibit 18, new wells can be constructed without WDNR review if they have a 250 ft minimum casing depth. Outside the 250 foot minimum casing depth area but within the lighter diagonal lined area, WDNR review and approval of proposed new wells is required. Regardless of location, all so-called "high capacity wells" (those with discharge rates exceeding 70 gpm) require WDNR review and approval.

WNDR advertises these SWDCA areas of groundwater usage restrictions to drilling contractors through their web site, and written notices. Since 2000, ten new wells have been constructed in the Lemberger SWCDA, however, none have been located within the plume nor within the 1200 foot boundary. During an April 29, 2010 conference call, Annette Weissbach, WDNR, explained that, under State of Wisconsin law, a variance from NR 812 is almost always granted when requested, pursuant to the legal theory that owners have a right to obtain water from their property (otherwise it may be perceived as a "takings" issue). The variance usually lists specific casing depth requirements so that property owners may use the groundwater even if the shallow groundwater is impacted by contaminants. She also noted that in some situations, requiring casing of more than 250 feet (for example, because of contamination) may exclude access to a viable aquifer. For example, deeper groundwater may be saline, sulfurous, or otherwise have poor quality.

Other ICs: In 1995, some off-site property owners where groundwater was contaminated entered access agreements with LSRG (see Exhibit 18). These agreements were amended in 2000. Among other provisions, the 2000 agreements require that the site owners "refrain from activity on the Property that could negatively affect the LSRG's remediation efforts or exacerbate the soil or groundwater contamination at or in the vicinity of the LL or LTR sites." These agreements were filed with the Manitowoc County Register of Deeds.

EPA and WDNR periodically inspect the LL and LTR sites. During EPA and WDNR's April 7, 2010 inspection, no evidence of inappropriate land or groundwater uses were observed. EPA and the State of Wisconsin have web sites that include information on LL and LTR. The LSRG regularly contacts residential well owners to sample their wells, and WDNR communicates the residential well sampling results.

IC Plan: In response to an EPA request, the LSRG submitted an IC plan dated July 2009, which, among other information included: the two May 20, 2009 restrictive covenants; an assessment of vapor intrusion risks from groundwater contamination; a description of State of Wisconsin regulations (see above description); an evaluation of the protectiveness of the 250 foot casing depth; information on zoning; an evaluation of the effectiveness of ICs; recommendations for improvements; and a recommended long-term IC monitoring strategy.

RMT concluded that risks from vapor intrusion from groundwater contamination are not significant. RMT recommended continued monitoring of the UGS and proposed 12 ug/l of TCE in the UGS as an action level to initiate further evaluation.

RMT predicted that there could be a risk of drawing in significant LL/LTR contamination at pumping rates less than the 70 gpm (definition of a high capacity well). In response to this, LSRG recommended that WDNR revise their special casing area requirements to specify either:

- that wells intended to pump at rates approaching 70 gpm (high capacity) either (i) be cased and sealed to below the Maquoketa Shale (about 450 feet bgs) or (ii) receive specific WDNR review and approval; or
- that WDNR contact, review and approval be required for all wells proposed to be constructed within the entire special casing area 18/19.

WDNR has begun the process of updating the special casing area associated with the Lemberger sites, in accordance with the September 2009 WDNR Guidelines contained in *Establishment of Special Well Casing Depth Area*. Considering that the Special Well Casing Depth Area was initially established in 1988, WDNR believes an update is appropriate and, in this process, will consider LSRG's recommendations.

The IC plan presented the Town of Franklin zoning. The LSRG requested that the Town of Franklin notify them of and allow them to participate in any plan commission consideration of changes to land use in the vicinity of LL or LTR. The LSRG has recommended to the Town of Franklin to changing zoning of the LL and LTR properties from General Agriculture to Landfill Overlay, or similar title.

In the IC plan. the LSRG concludes that the existing ICs along with the access and engineering controls, provide sufficient layering to ensure that the public will not be exposed to harmful contaminants, but recommended some additional actions (noted above) and long-term monitoring as described below.

IC long term monitoring strategy: In the IC plan, the LSRG committed to perform the following to maintaining existing ICs:

- obtain and record additional restrictive covenants when necessary;
- continue to work with the Town of Franklin Plan Commissions to learn of proposed changes to land use and development plans;
- continue to work with WDNR on special casing depth area requirements;
- request information on new and existing wells during resident contacts for well sampling;
- notify EPA and WDNR as soon as practicable upon discovery of any significant activity that is inconsistent with the IC objectives.;
- work with EPA and WDNR to determine a plan of action to rectify problems;
- every five years, ensure that LL and LTR are listed in the WDNR database, and that the database contains appropriate documents and identifies appropriate and relevant continuing obligations;
- every five-years, perform a visual field survey to locate new development or property uses in the area;
- every five years, submit a report to EPA reporting on and evaluating the effectiveness of the ICs; and
- prior to deletion from the National Priorities List, evaluate whether a formal petition from a zoning change is necessary;.

Providing a report on the effectiveness of ICs every five-years should be sufficient for the following reasons: WDNR should be notified of new wells being installed in the SWCDA, the LSRG periodically communicates with residential well owners, property owners, and the Town of Franklin; LSRG representatives are regularly on-site for O&M activities; and the LSRG has committed to notify EPA and WDNR of any significant activity that is inconsistent with the IC objectives.

V. Progress Since the Last Review

Following is the protectiveness statement from the 2^{nd} *Five-year Review Report* dated September 21, 2005:

> The remedies at the Lemberger Landfill (LL) and Lemberger Transport Sites (LTR) are currently protective of human health and the environment in the short term because the landfill caps, the LL slurry wall, gas vent system, leachate collection system and groundwater pump and treat system continue to function adequately in

order to prevent exposure. Access to the site is controlled, and groundwater and nearby residential wells are monitored as required. Groundwater in residential wells within the contaminant plume do not exceed State or Federal drinking water standards. Data indicate predominantly stable concentrations of contaminants in area monitoring wells and leachate head levels in the LL are decreasing. However, it does not appear that the groundwater cleanup goals will be achieved within the timeframe that was originally anticipated. The current pump and treat system has not reduced the size of the plume which exceeds the cleanup levels and it appears that natural attenuation rather than active pumping may have removed most of the contamination to date. Therefore, the Agencies have approved the LSRG's request to perform an engineering demonstration project to temporarily shut down the pump and treat system and evaluate whether natural attenuation is occurring and what the impact is on the groundwater contaminant plume. Additionally, institutional controls must still be completed at both sites to prevent site development and installation of drinking water wells. Long term effectiveness will be achieved at both the LTR and LL sites when groundwater cleanup goals have been achieved and the institutional controls are in place.

The following table indicates that all of the issues identified in the *2nd Five-year Review Report* have been addressed.

Table 4: Actions Taken Since the 2005 Five-Year Review

Issues from Previous Review	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
ICs	Submit an IC plan	LSRG / property owners	3 / 2006	Completed	4/23/2010
Groundwater Remedy	Issue an ESD	EPA	2005	ESD issued	9/27/2006
Groundwater Remedy	Conduct a MNA study	LSRG	2008	Completed	4/17/2009
Site maps	Include topography and soil gas monitoring locations on LTR map Extend cross section to Branch River	LSRG	2006	Submitted as built map of LTR site cover Included in MNA Report	5/17/2010 12/15/2008

Relative to the schedule of the IC work, in 2005 a deed notice containing some usage restriction language was already in placed on the LL and LTR properties. The LSRG started working on restrictive covenant language consistent with EPA and WDNR model language prior to completion of the *2nd Five-Year Review Report.* After working out language with EPA, the LSRG negotiated with the site owner to accept the revised language. The restrictive covenants for the LL and LTR properties were signed by the property owner on May 20, 2009. In response to an EPA comment, the LSRG is working on getting a property owner signature for a corrected property description for LTR. In response to guidance provided by EPA in August 2008, the LSRG provided its first draft IC plan in December 2008. The LSRG provided the final corrections to the IC plan on April 23, 2010.

Relative to the schedule of the MNA study, RMT submitted *Work Plan for Monitored Natural Attenuation Demonstration Project* in April 2006. The last quarterly sampling for this demonstration project was performed in July 2008, and a report on the results provided in December 2008. On April 17, 2009, RMT submitted additional documentation and explanation in response to EPA and WDNR comments.

VI. Five-Year Review Process

Administrative Components of the Five-Year Review Process: During a meeting including representatives of RMT, LSRG, EPA, and WDNR in August 2009, the possibility of coordinating future submissions with the schedule for completion of the third five-year review, was discussed. The RPM initiated work in the third five-year review in December 2009, and notified representatives of RMT, LSRG, WDNR and other reviewers of initiation of the review on January 20, 2010. The RPM sent an initial draft for review by Region 5 EPA staff, WDNR staff, and David Dougherty on February 22, 2010. Initial EPA reviewers included: Luanne Vanderpool, Ph.D, Geologist; David Wilson, GEOS Project Officer; Donald Bruce, Chief, Remedial Response Section 5; Nola Hicks, Associate Regional Counsel; and Sheri Bianchin, IC Coordinator. Andrew Podowski provided input into the toxicity of DCA. WNDR reviewers included Annette Weissbach and Gary Edelstein. An updated draft was sent to RMT, the LSRG, and EPA Headquarters on April 7, 2010. After a meeting with EPA, the LSRG requested to submit their comments on May 21, 2010. Because EPA wanted LSRG's input before finalizing the five-year review report, EPA missed the first target signature date of May 15, 2010. After receipt of comments from EPA Headquarters, LSRG, and final comments from other reviewers, the final five-year review report was prepared for approval.

Community Notification and Involvement: Contact with some local residents regularly occurs when RMT samples private wells. RMT submits the private well data to WDNR and EPA. WDNR routinely submits letters to the affected local residents providing the results of this sampling. RMT has reported that Mark Brooks of RMT has been participating in the Friends of the Branch River Watershed organization. In March 2006, EPA mailed letters to all private well owners whose wells are included in the monitoring program informing them of the upcoming MNA demonstration project. EPA provided a notice of the 2006 ESD in the November 22, 2006 edition of the Manitowoc Herald Times Reporter. EPA received no formal responses to this notice. A public notice of the five-year reviews for LL and LTR was published in the Herald Times Reporter on February 15, 2010 (Exhibit 21).

Document Review: Investigations, evaluations, and monitoring are in progress at LL and LTR. Documents still being reviewed or completed during this five-year review include the IC plan, the MNA Report, the *Leachate Evaluation Report for the Lemberger Landfill*, and reports further evaluating use of pump-and-treat and other technologies. In addition, the following documents were reviewed along with related correspondence:

- *Final Remedial Investigation Report for Lemberger Landfill Inc. and Lemberger Transport and Recycling Inc.Sites*, B&V Waste Science and Technology Corp., January 18, 1991;
- *Final Public Comment Phased Feasibility Study Report for Lemberger Landfill, Inc. and Lemberger Transport & Recycling, Inc. Ground Water and Lemberger Landfill, Inc. Source Control Operable Unit*, B&V Waste Science and Technology Corp., May 10, 1991;
- 1991 ROD;
- 1992 Consent Decree;
- *Lemberger Transport and Recycling Inc. Site Source Control Operable Unit Remedial Investigation Technical Memorandum*, B&V Waste Science and Technology Corp., October 1992;
- Administrative Order by Consent, July 15, 1993;
- *Final Phase 2 Drum Excavation Remedial Workplan for Lemberger Transport and Recycling*, Malcomb Pirnie, November 2, 1993;
- ROD, September 28, 1994;
- *RD/RA Final Design Report, Lemberger Landfill*, Malcomb Pirnie, January 10, 1995;
- *Final Design Report Lemberger Transport & Recycling Site Closure*, Malcomb Pirnie, October 6, 1995;
- preliminary closeout report for LL, September 9,1996 ;
- Preliminary Closeout Report for LTR, October 22, 1996;
- OMP, February 1997;
- *Lemberger Landfill Closure System and Groundwater Treatment System,* Malcomb Pirnie, April 1997;
- *Leachate Head Monitoring Report*, RMT, September 2000;
- *Project Description and Basis of Design Groundwater Extraction System Improvements*, RMT, August 2001.
- Semi-annual Progress Reports 9 (January - June 2001), 10 (July – December 2001) and 12 (July – December 2002), RMT;
- 2000 *Five-year Review Report*;
- *Construction Documentation Report*, RMT, April 2002;
- *Proposed Revisions to the Groundwater Monitoring Program*, RMT, October 2003;
- *Assessment of Remedial Action Effectiveness*, RMT, June 2004;
- private well sampling results 2007 – 4/ 2009;
- letter regarding Lemberger Site, RMT, February 9, 2005;
- *Work Plan for Field Investigation of Bedrock Characteristics*, RMT, April 2005;
- O&M Progress Report No. 15, RMT, September 2005;
- 2005 *Five-Year Review Report;*
- *Workplan for Monitored Natural Attenuation Engineering Demonstration Project*, RMT, April 2006;
- Explanation of Significant Differences (ESD), September 27, 2006;
- *O&M Progress Report No. 16*, RMT, November 2006;
- *Field Investigation of Bedrock Characteristics*, RMT, June 2006;
- *Leachate Head Evaluation Report for Lemberger Landfill*, RMT, October 2007;
- letter regarding interim groundwater monitoring program, RMT, August 28, 2008;
- letter regarding residential well construction logs, RMT, November 19, 2008;
- *O&M Progress Report No. 19*, RMT, January 2010.

Primary guidance documents used for interpretation of biodegradation include:

Technical Protocol for Evaluating Attenuation of Chlorinated Solvents in Ground Water, EPA/600/R-98/128, September 1998;

Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage tank Sites, OSWER Directive 9200.4-17P, April 1999; and

Principles and Practice of Enhanced Anaerobic Bioremediation of Chlorinated Solvents (Air Force Center for Environmental Excellence, Naval Facilities Engineering Service, and Center and Environmental Security Technology Certification Program, August 2004).

The primary document for screening risks is: "Regional Screening Level table (RSL) Master April 2009", EPA Region 3.

Data Review
DATA QUALITY: The primary QAPP for the long term monitoring was included in the 1999 OMP. Table 3-3 of the QAPP lists the method detection limits (MDLs) and reporting limits for target compounds. For this five-year review, the MDLs were compared to the MCLs, PALs, and for contaminants that lack either of these standards to RSLs. Table 5 lists the contaminants whose MDLs exceed either an MCL, PAL or RSLs by a factor of two or more:

TABLE 5: TARGET COMPOUNDS WHOSE MDL EXCEEDS ITS PAL OR RSL (by a factor of two or more, MDL is from QAPP in OMP)

CONTAMINANT	MDL, ug/l	PAL and/or RSL, ug/l
2,4-dinitrotoluene	1.1	0.22 (RSL)
3,3'-dichlorobenzidene	0.8	0.15 (RSL)
benzo(a)anthracene	0.78	0.029 (RSL)
benzo(a)pyrene	0.58	0.2 (MCL),0.02 (PAL),
benzo(b)flouranthene	0.85	0.02 (PAL)
benzo(k)flouranthene	0.73	0.29 (RSL)
bis(2-chloroethyl)ether	1.53	0.012 (RSL)
hexachlorobenzene	0.87	0.1 (PAL)
indeno(1,2,3-cd)pyrene	0.61	0.029 (RSL)
nitrobenzene	1.48	0.12 (RSL)
PCBs	0.017	0.5 (MCL), 0.003 PAL
pentachlorophenol	0.87	1.0 (MCL), 0.1 (PAL)
Thallium	3.4	2 (MCL), 0.4 (PAL)

Using analytical procedures that do not achieve the PALs or RSLs is especially a concern for contaminants known to be a concern at the sites. PCBs and some cPAHs (benzo(a)anthracene; benzo(a)pyrene; benzo(b)flouranthene; benzo(k)flouranthene; and indeno(1,2,3-cd)pyrene) were identified as chemicals of concern in the RI. Wastes disposed at LTR are known to have contained PCBs[10] and cPAHs[11], and some test pit

[10] PCB spill cleanup wastes were disposed at LTR.

soils at LTR contained high concentrations of PCBs and cPAHs. Pentachlorophenol was not identified as a chemical of concern in the RI, but it was detected at 2300 ug/kg in an LTR test pit sample. Although PCBs were only detected in two groundwater samples in the RI (2.7 ug/l and 2.5 ug/l), pentachlorophenol in one (4 ug/l), and PAHs have not been detected in groundwater, there is concern that these contaminants may be present exceeding the MCL, PAL or RSL in groundwater because the MDLs of the laboratory methods used significantly exceed these standards.

The other contaminants listed in Table 5 were not identified as chemicals of concern in the RI, and are not known to have been disposed at LL or LTR. Except for nitrotoluene, and thallium, the other parameters were not detected in soil or groundwater samples during the RI. Nitrotoluene was only detected in one sediment sample (120 ug/l). Thallium was not detected in groundwater, and was detected only at trace concentrations in other media.

In spite of satisfying data verification and validation requirements, there have been BEHP detections that are believed to be caused by laboratory contamination. Consistent with previous data, during the MNA study BEHP was detected exceeding the ES (6 ug/l) in groundwater from seven of the sentinel wells (RM-002D, RM-203D, RM-203I, RM-210D, RM-210I, RM-212D, and RM-212I) varying in concentration from 7.9 to 97 ug/l (BEHP was not analyzed in other monitoring well samples during the MNA study). In addition, BEHP was detected at 36 ug/l in groundwater from source area pumping well EW-06D in 2006. To investigate the distribution and frequency of BEHP detections, RMT prepared a plot showing all BHEP detections in groundwater from 1997 to 2008 (see Exhibit 22). BEHP detections have not been consistent at any well and do not appear to be focused on LL or LTR. For those reasons, and because BEHP is frequently a laboratory contaminant, it is believed that laboratory contamination has been the source of the BEHP detections in this project.

EPA approved an addendum to the QAPP for the MNA demonstration project on June 15, 2006. In accordance with the QAPP, RMT has provided a report on the data validation for all of the groundwater samples.

Starting with the baseline sampling for the MNA study in 2006, groundwater was sampled using a low-flow sampling method, instead of using bailers. A dedicated bladder pump was used for sampling each monitoring well. RMT validated the laboratory data from all of the groundwater sampling, and included a report on the validation in quarterly reports.

In a September 10, 2007 letter, WDNR approved the following revision to the sampling and analysis procedures for VOC samples from residential wells: starting in September

11 An estimated 480,000 gallons of wood tar distillates were disposed at LTR, and black tar like material was observed during the test pit sampling. Wood tar is a partially combusted material, and would be expected to contain cPAHs.

2007, VOC samples will be unpreserved, but will be analyzed within seven days of collection. The reason for this revision was to prevent false detections of chloromethane.

DO results from the in-line sampling probe for the low-flow sampling were questioned during the MNA study. To double check results, the groundwater was tested using CHEMets® ampoules. In general, the DO results using the ampoule method matched the probe readings.

MONITORING TO BOUND THE CONTAMINATION AND PROTECT WELL USERS: No VOCs attributable to LTR or LL were detected in private well sampling results from March 2007 to April 2009.[12] As discussed in the IC section, a large area surrounding LL and LTR is subject to restrictions on installation of new wells. WDNR will be updating these restrictions, and restriction procedures to take into account new information.

Currently, the following private wells are scheduled to be sampled annually: GR-8; GR-9; GR-10; GR-11; GR-12; GR-16; GR17; GR-30; GR-31; GR-33; GR-41; GR-62; GR-63; GR-64; and GR-65 (see Exhibit 9). Wells GR-8, GR-9, GR-10, GR-11, GR-12, GR-17, GR-62, GR-63, and GR-64 are within or near the area of the down-gradient groundwater contamination. In 1985 a number of wells in this area were contaminated and replaced with wells cased at about 250 feet bgs, which is much deeper than the down-gradient sentinel wells, which are screened at 50 to 60 feet bgs. GR-16, GR-24, GR-30, GR-31, GR-33, GR-41, and GR-65 are in the vicinity of the sites but appear to be outside the flow paths of the groundwater contamination.

Currently semiannual sampling is required for the following private wells: GR-13; GR-14; GR-15; GR-25; GR-26; GR-27; and GR-60R. GR-60R and GR-26 lie west of LTR and do not appear to be directly within the flow path of groundwater contamination from LTR, but CVOCs were previously detected at GR60R, and are still detected at RM-101D. GR-60R and GR-26 do not appear to be sufficiently separated by depth from contamination detected at RM-7XXD, which monitors groundwater at 190 to 195 feet bgs. The top of the screen at GR-60R is at 252 feet bgs and at GR-26 is 210 feet bgs. Considering the topography, the elevations of these wells are similar to the elevation of RM-7XXD. There is no sentinel well between these private wells and LTR.

The depths of the casings are unknown at GR-25 and GR-27. GR-25 lies northeast of LTR and east of the groundwater contaminant plume from LTR. There is no sentinel well between LTR and GR-25. It is possible that GR-27 is directly down-gradient from

12 In June 2007 trace levels of chloromethane were detected in three private well samples. RMT suspected that the detection could have resulted from addition of the hydrochloric acid preservative. With EPA and WDNR's approval, starting in September 2007 RMT did not add the hydrochloric acid preservative to private well samples, but analyzed the samples within one-week of collection. Since that date there have been no chloromethane detections in private well samples. In December 2007 a trace level of methylene chloride was detected a duplicate for one private well sample. This is suspected to be a false detection because methylene chloride is a chemical commonly used in laboratories, and it was not detected in the corresponding non-duplicate sample.

groundwater contamination detected at RM-3D, which is only about 500 feet east of GR-27.

GR-13, GR-14, and GR-15 are northwest of LTR and LL. Potentiometric surface maps indicate that GR-13, GR-14, and GR-15 could be down-gradient from LL and LTR, and in the past CVOCs were detected at GR-13 and nearby wells RM-2D and RM-2I, but the center of the plume appears to be somewhat west of this location. The depths of GR-13 and GR15 are unknown, and GR 14 is only 45 feet deep. Monitoring RM-2I and RM-2D may provide a warning that contamination is reentering the vicinity of GR-13, GR-14, and GR-15.

RMT also located well information for five relatively shallow wells, which RMT assumes (but has not verified) were abandoned.

WDNR has reported that ten new wells have been constructed in the Lemberger SWDCA since 2000. Presently, the OMP includes no provision for incorporating new private wells into the residential well monitoring program. WDNR would like to assure that:

- if a new well is installed within the known plume boundary, it will automatically be added to the residential well monitoring program; and
- new wells located outside the plume but within the SWCDA will be added to the residential well monitoring program if determined to be necessary.

In August 2009, RMT proposed an interim post-MNA monitoring program. This interim program was approved by EPA with changes in December 2008, and includes quarterly sampling of sentinel wells, semiannual sampling of certain private wells, and annual sampling of other groundwater monitoring wells, and other private wells. The following wells are categorized as sentinel wells: RM-203I, RM-203D, RM-210I, RM-210D, RM-2D, RM-212I, RM-212D, RM-3D, RM-211D, RM-7XXD, and RM-208XD (see Exhibit 17). The purpose of sentinel wells is to detect expansion of groundwater contamination. The sentinel wells appear to be adequate to monitor for expansion of CVOCs exceeding the PALs in groundwater along the most probable flow pathways, which is in the LGS through the lower granular unit and upper bedrock, except for groundwater in the far down-gradient plume, where RM-203I, RM-203D, RM-210I, and RM-210D may be located east of the most contaminated flow pathway, and where the ES and PAL for TCE is already exceeded (see Exhibits 23 through 26). It has been assumed that all of the down-gradient groundwater contamination migrates into to the Branch River, but this has not been proven (see Exhibit 4). More monitoring, investigation and/or evaluation appears to be needed to define the location and extent of the far down-gradient CVOCs, and whether and the quantity of CVOCs that migrates into the Branch River.

In addition, the CVOCs exceeding PALs in groundwater are not bounded by depth except by RM-7XXD and at RM-208XD (see Exhibit 4). The down-gradient sentinel wells are only screened at 50 to 60 feet bgs while many of the residential wells are screened at 250 feet bgs and lower. As a result, the down-gradient sentinel wells cannot provide an early warning for contamination approaching residential wells that are screened deep in the bedrock. More monitoring, investigation, and/or evaluation are needed to define the depth of the CVOC contamination in the down-gradient plume area.

At sentinel wells RM-2D and RM-2I, trends in TCA, DCA, TCE, and/or Cis detections suggest that since shut-down of pumping, CVOC contamination is shifting to the west and reentering the vicinity of residential wells GR-12, GR-13, GR-14, and GR-15 (see VOC concentration trend graphs in Exhibit 27). During the pumping, CVOCs decreased to non-detect at these locations, but since cessation of pumping TCA, DCA, TCE, and Cis have been detected in RM-2D and/or RM-2I.

Similarly the apparent increases in TCA, DCA, TCE, and Cis at RM-3D, RM-3I, and RM-211D since shut-down of pumping suggest that more CVOC contaminated groundwater may be migrating west and reentering the vicinity of GR-27 This contamination may also eventually migrate down-gradient and impact other residential wells. Further westward migration could also impact GR-26 and GR-60R (in the past, CVOCs were detected at GR-60, which was replaced by deeper well GR-60R).

In September 2008, because of increasing concentrations of CVOCs detected in RM-7XD near LTR (see Exhibit 27), RM-7XXD and RM-208XD were installed to bound the depth of groundwater contamination exceeding the PALs near LTR. When RM-7XXD was installed, there were very low CVOC detections near 190 feet bgs based on vertical aquifer sampling during the initial boring (see table below). Therefore, RM-7XXD was installed with a screen depth of 190 to 195 feet bgs. CVOC results at RM-7XXD exceeded some PALs in October 2008 and April 2009 but not in the four subsequent sampling events. The data indicate that RM-7XXD is screened near the lower vertical boundary of the groundwater exceeding the PALs.

Table 6: DATA FROM SAMPLING RM-7XXD (results in ug/l, ND = not detected, detections exceeding PALs (TCA = 40 ug/l; DCA = 86 ug/l; 1,1-DCE = 0.7 ug/l; Cis = 7 ug/l; TCE = 0.5 ug/l) are bolded)

DATE	TCA	DCA	1,1-DCE	CIS	TCE
09/2008	1.3	1.6	ND	ND	ND
10/16/2008	**45.9**	38.6	**3.1**	**13.9**	**3**
2/19/2009	6.6	4.7	<0.57	1.3	<0.48
4/7/2009	26.6	26.9	<0.57	**7.6**	**0.98**
7/23/2009	2.4	2.8	<0.57	0.83	<0.48
9/29/2009	1.3	1.8	<0.57	<0.83	<0.48
12/14/2009	1.8	2.8	<0.57	<0.83	<0.48
Frequency exceeding PAL	**1/8**	**0/7**	**1/7**	**2/7**	**2/7**

The depth of the contamination indicates that contaminants migrated downward from

LTR through fractured bedrock due to either mounding or gravity-driven flow (either DNAPL or density-driven flow). Vertical fractures were identified in the boring logs, for example RM-208XD at depths of 103 and 114 feet bgs, and numerous bedding fractures have been observed in the bedrock borings all over the site. These and other investigatory data provide evidence of an interconnected network of fractures in the dolomite. It is not possible to map all of the fractures. Because of heterogeneities and interconnectedness of the fractured porous bedrock, it is possible that there are other locations hydraulically down-gradient of LTR at which groundwater concentrations exceed PALs at the same 190 foot depth, or even deeper. This interpretation further supports the need for more monitoring to determine the depth of the CVOC contamination down-gradient, and indicates that the existing sentinel wells do not provide an early warning for private wells screened in the deep bedrock.

LANDFILL GAS MONITORING: The 36 landfill gas vents and 6 soil gas probes at LTR have continued to be monitored annually from 2004 through 2009, and no significant methane or total VOCs have been detected. No odors or emissions from the LL or LTR landfill gas vents were noticed du ring EPA and WDNR's April 7, 2010 site inspection. Considering these results, it appears that sufficient data has been gathered to confirm that landfill gas is not a problem, and this sampling can be discontinued.

VAPOR INTRUSION FROM THE GROUNDWATER CONTAMINATION: In the July 2009 IC plan, RMT concluded that, at current VOC concentrations in the UGS, vapor intrusion from groundwater contamination does not have the potential to be significant. RMT advised continued sampling of the UGS, and proposed 12 ug/l of TCE in the UGS as an action level for further evaluation of this concern.

AIR EMISSIONS FROM THE GROUNDWATER TREATMENT: The RPM could locate neither the limitations nor any monitoring data for air emissions from the groundwater treatment system. It is believed that before startup of the pump-and-treat, WDNR determined that emissions would be insignificant, and permitting and monitoring were not required.

PROTECTION OF AQUATIC LIFE IN THE BRANCH RIVER: RMT has routinely submitted monthly discharge monitoring reports, and annual toxicity tests to WDNR. No violations of discharge requirements were identified. RMT summarized the effluent data in *O&M Progress Report No. 16* and reported that the effluent complied with all discharge limitations.

Monitoring the Branch River for the impact of groundwater migration was not included during the MNA study because VOC concentrations in monitoring wells near the Branch River were very low, and because no VOCs associated with LL or LTR were detected in Branch River sediment samples collected in December 1998 and September 2000. RM-203I and RM-203D are the monitoring wells closest to the Branch River and are within the pathway of the LL / LTR groundwater contamination. During the MNA study, VOC concentrations in groundwater at RM-203I and RM-203D did not increase.

Detections of organic compounds during the MNA study in groundwater samples from RM-203D ranged from: TCA, 5.2 to 6.2 ug/l; DCA, 1.5 to 2.5 ug/l; Cis, 0.97 to 1.2 ug/l; TCE, 0.58 to 0.74 ug/l; and BEHP, < 1 to 78 ug/l. Detections of organic compounds during the MNA study in groundwater samples from RM-203I ranged from: TCA, 1.8 to 3.6 ug/l; BEHP, < 1 to 56 ug/l. The distribution of BEHP detections from previous sampling events appears to indicate that the BEHP detections are not related to LL or LTR. Metals appeared to be at background concentrations.

Groundwater concentrations that are protective to surface water have not been defined for LL or LTR, because the remedy requires containment of the groundwater contamination by the pump-and-treat system. As a rough screen an estimate of the pounds of VOCs entering the Branch River from groundwater can be compared to the discharge limitations on the groundwater treatment discharge:

Lb/day = contaminated groundwater vent rate X concentration
entry rate[13] = width X depth X velocity X porosity ~ 2000 ft X 50 ft X 600 ft/yr X 0.1
= 6,000,000 ft^3 / yr = 460,000 liters/day
For TCA, concentration ~ 5 ug/l = 1.1 $^{-8}$ lb/l
Therefore, the TCA entry rate to the Branch River is estimated to be 0.005 lb/day (about 2 lb/year), which is much less than the 15.6 lb/day monthly average allowed for the groundwater treatment system discharge. Similarly, the TCE entry rate is estimated to be 0.0005 lb/day, which is much less than the 0.392 lb/day allowed. However, this screening does not address potential impacts on benthic organisms prior to mixing with the river water.

OFF-SITE DISPOSAL: RMT estimates that a total of about eight million gallons of leachate were removed by the leachate withdrawal system.

The OMP included the first wastewater discharge permit for the leachate from Heart of the Valley Metropolitan Sewerage District effective January 1997. The most up to date permit from Heart of the Valley Metropolitan Sewerage District was provided in an April 23, 2010 letter from RMT. The progress reports have included a summary of the parameters detected in the leachate samples. A comparison of the detections to the discharge limitations in the January 1997 permit, do not indicate a compliance concern.

According to the site operator (April 23, 2010 letter), groundwater treatment residuals generated were fluid enough to be added to the leachate tanks for disposal with the leachate. For example, during a site inspection, the site operator explained that waste muriatic acid washes used to clean air stripper parts were added to the leachate tanks (see Exhibit 28, the April 7, 2010 memorandum on EPA and WDNR's inspection).

13 In actuality the interactions of groundwater and surface water changes significantly along the channel. In fact some along some reaches groundwater vents to the River and in other reaches the River recharges groundwater.

MAINTENANCE OF SITE COVERS AND FENCES: The OMP provides for the following inspections: semiannual inspections of the landfill cover, erosion control system, visible portions of the leachate wells, landfill gas vents, perimeter gas probes, fence; and, during each sampling round, pumping wells, monitoring wells and peizometers. The LSRG provides a full time technician to maintain the site. Although the OMP document was not present on site, this operator appeared to be knowledgable of the details of O&M during EPA and WDNR's site inspection on April 7, 2010 (Exhibit 28).

The progress reports stated that the grass was cut on LL and LTR as necessary, but included no documentation that the inspections required in the OMP were being performed. However, EPA and WDNR inspectors observed that the LL and LTR site covers were well vegetated and fences were in good shape during the April 7, 2010 inspection. The only problems identified involved improved documentation and routine maintenance work. In an April 23, 2010 letter, RMT stated that site cover inspections were performed at least quarterly during the last five years and that no problems were observed during these inspections. RMT also provided a site inspection checklist for a site inspection on April 13, 2010. The checklist for the April 13, 2010 inspection identified some of the same routine maintenance concerns identified in EPA and WDNR's inspection. In a May 21, 2010 letter from RMT, the LSRG stated that future progress reports will include site cover and well inspection forms.

CONTAINMENT OF LL LEACHATE: The 1991 ROD provided that the groundwater withdrawal must continue as long as contaminated groundwater within the slurry wall is generated, and result in an inward groundwater gradient at all points within and at the edges of the waste mass. The OMP required leachate head levels to be reduced to one foot above the top of the clay confining unit. To achieve these requirements, leachate removal rates, although variable, have been maintained (see Exhibit 16). To maintain leachate removal rates, O&M progress reports indicate that LL leachate pumps were regularly removed and cleaned.

In October 2007, RMT submitted *Leachate Head Evaluation Report*, in which RMT summarized the leachate head trends, and proposed discontinuation of the leachate withdrawal for one-year to evaluate the impact on leachate heads. The leachate head hydrographs indicated the following: all leachate heads were far more than one foot below the bottom of the waste; leachate heads had been reduced to one foot above the clay confining layer at five of the nine leachate head monitoring points; the leachate heads in other LH wells were continuing to decrease; and data from two wells identified a pattern of annual sharp increases during spring indicating a connection to the UGS. Exhibit 15 reproduces an RMT-prepared figure that presents leachate head data and RMT's estimate of areas that had and had not achieved the 1 foot above confining layer level target.

From review of construction notes, RMT prepared a figure (Exhibit 29) that indicates that about 1100 feet of slurry wall bounding the southeastern corner the LL was keyed to bedrock instead of into the clay confining unit, and that about 200 feet of slurry wall may have had sand instead of clay below the slurry wall. This information shows that the 1991 ROD requirement that the slurry wall be keyed into the clay layer and the design document requirement that the slurry wall be keyed three feet into the clay layer, were not fully achieved because of field conditions. RMT concluded that the sand below the slurry wall likely contributes to leakage from the UGS into LL, and it is possible that there is leakage where the wall is keyed to bedrock because the bedrock surface is rough and irregular. These conditions explain the seasonal leachate head patterns at LH-06 and LH-07, and why lowering of leachate head levels has taken longer than expected in that area. The sand and the presence of bedrock instead of clay below LL, could also result in more leakage to the LGS (see Exhibit 30).

After discussions with EPA and WDNR, RMT submitted *Workplan for Lemberger Landfill Water Level Head Demonstration Project* dated October 2008. This workplan provided details for monitoring during a proposed one-year interruption of the leachate withdrawal, including: measuring leachate and UGS head levels every two weeks from January through June 1, 2009, and monthly for the remainder of the year; and VOC sampling of leachate head (LH) wells prior to shut-down. The purpose of the VOC analyses is to evaluate the change in leachate quality since July 2000, and better assess the potential for the LL leachate to contaminate the UGS and LGS. It is noted that VOC detections in the composite leachate samples for disposal have been low (between July 2007 and June 2009, the only VOCs detected were benzene at up to 6.9 ug/l, methylene chloride at 0.8 ug/l and vinyl chloride at up to 4.5 ug/l). The workplan included a contingency to reinitiate leachate withdrawals, if a leachate head increased to within one foot of the base of the waste. EPA approved this plan in November 2008. RMT performed the demonstration from December 2008 until December 2009, and submitted a report in February 2010.

During the demonstration project leachate heads from LH wells did not significantly increase and all leachate levels remained more than one-foot below the bottom of wastes. However, heads at leachate withdrawal (LW) wells increased an average of 6.9 ft (compare 2009 leachate heads in Exhibit 31 to 2007 leachate heads in Exhibit 15). Although the increased heads in LW wells are likely to have resulted from pumping effects, which depressed leachate levels below equilibrium during the leachate withdrawal period, there is concern that leachate heads on the west side of LL exceed UGS heads (see Exhibit 31). This indicates that there is potential for leachate migration from LL to the UGS, and that the remedy is not achieving the 1991 ROD requirement that the groundwater withdrawal must result in an inward groundwater gradient at all points within and at the edges of the waste mass.

On the other hand, the December 2008 VOC sampling of the LH wells indicates that, under existing conditions, the potential for LL leachate to contaminate the UGS or LGS has decreased substantially since 2000. Leachate samples could only be collected from four locations because leachate levels have decreased since 2000, and VOC concentrations were much lower those samples (see comparison in Exhibit 32). Still, at one location (RM-15R), vinyl chloride was detected at 16.4 ug/l exceeding the MCL (2 ug/l) and the ES (0.2 ug/l), and 1,2-DCE (total) was detected at 40 ug/l, which exceeds the PAL for Cis (7 ug/l) and trans- (20 ug/l).

Based on the results of the demonstration project, RMT has recommended the following:

- continuation of monthly leachate head and groundwater level monitoring;
- annual sampling of leachate; and
- maintenance of the leachate withdrawal system so it can be placed in operation if necessary; and
- reinitiation of the leachate removal only if found to be necessary.

RMT's recommendations conflict with the 1991 ROD requirements that the leachate withdrawal continue as long as contaminated groundwater within the slurry wall is generated, and to maintain an inward gradient at all points within and at the edges of the waste. EPA and WDNR are reviewing RMT's report.

OPERATION, MAINTENANCE AND MONITORING OF PUMP-AND-TREAT: *O&M Progress Report No. 16* states that the volume of groundwater pumped from July 2005 through June 2006 was 96,849,600 gallons (yearly average = 184 gpm), and the volume removed since startup was 1,046,682,994 gallons. Scale build up was removed from the air stripping units and associated air distribution headers, and pneumatic pumps in EW-6D and EW-9D were removed and sent for maintenance. EW-6D and EW-9D were inoperative for about two months during this maintenance.

RMT discontinued pumping to perform the MNA study on August 2, 2006. Pumping rates from down-gradient pumping wells EW-2D, EW-3D, EW-4I and EW-4D were maintained near the design rates until shut-down. Pumping rates from source area wells were low, as summarized in Table 7 below. Since shut-down of the pump-and-treat system for the MNA study, RMT has operated the system for a brief time on at least a quarterly basis to verify that the equipment is in good working order. During these operating times, treated groundwater was discharged to the Branch River, and samples of the treated discharge collected before shut down.

Table 7: Pumping Rates from Source Area Wells since September 2005 (in gpm, listed from first week to end week within time period, NM means not measured)

TIME PERIOD	EW-1D	EW-7D	EW-6D	EW-8D	EW-9D
Design Rate	25	50	25	25	25
9 – 12 / 2005	0.23 – 0.24	6.5 – 5.7	0.046 - NM	0.11 - NM	0.068- NM
01 – 7 /2006	0.25 – 0.013	6.6 – 6.3	0.11 – 0.13	0.11 – 0.15	0.11 – 0.15
Since 8/2006	0	0	0	0	0

The progress reports have not identified any efforts to increase pumping rates since installation of four additional source area pumping wells and reaming EW-1D in 2001.

Concern that VOC concentrations were not decreasing as quickly as expected in down-gradient groundwater resulted in submission of *Assessment of Remedial Action Effectiveness* in June 2004, in which RMT advocated a two year MNA study, during which the pump-and-treat would be shut-down. During 2005 and 2006 the bedrock investigation was conducted, and resulted in submission of *Field Investigation of Bedrock Characteristics* in June 2006. Part of the purpose of this investigation was to gather information to better evaluate the feasibility of achieving hydraulic control near the boundary of LTR, but the report neither drew a conclusion about the feasibility of this objective nor proposed further work to pursue this objective.

During the period of the MNA study, the annual progress reports did not include groundwater data because it would be incorporated into reports for the MNA study. *O&M Progress Report 19*, which is for the period from July 2008 through June 2009, should have included a summary of the groundwater data collected following the final MNA study sampling in July 2008, but did not. According to Section 4.8.2 of the OMP *O&M Progress Report 19* should have included: a tabular summary of the groundwater elevation and analytical data; a water contour map; a tabulation of vertical gradients; and at least one representative iso-concentration map. After being notified by EPA, RMT provided some of the data and evaluations in an April 23, 2010 letter.

Concern that CVOC concentrations at RM-7D and RM-7XD were increasing resulted in installation of RM-7XXD in September 2008, which indicated that the CVOC contamination exists deeper than expected near LTR. It does not appear that the pump-and-treat was capturing the deep groundwater contamination at LTR.

BEDROCK FIELD INVESTIGATION: RMT submitted *Field Investigation of Bedrock Characteristics at the LTR Site* to EPA on June 29, 2006. The study included installing nine boreholes at six locations ranging in depth from 78 to 91 feet bgs. Three locations were near the northern property boundary (down-gradient edge) of LTR (see locations B-1, B-2 and B-3 in Exhibit 17), two were between LTR and LL (see RM-213D and RM-214D in Exhibit 17) and one was approximately 1500 feet northwest of LTR and 700 feet directly west of the southwest corner of LL (see B-5 in Exhibit 17). None of the boreholes investigated bedrock directly beneath LTR.

No free product was detected in any of the borings, which eliminated concern about DNAPL ponding on top of the bedrock near and beyond the northern boundary of LTR (especially near B-2 where there appears to be a bedrock valley). DNAPL was also not observed during the RI. It was found that there were high porosity zones in the bedrock and little solution weathering, although occasional solution features are readily observed in the dolostone face at the quarry southwest of LTR.

Groundwater CVOC concentrations collected from discrete intervals in the boreholes were similar to concentrations detected at nearby monitoring wells. In the three borings at the northern boundary of LTR, samples of rock matrix from selected intervals within about one foot of fractures were collected and analyzed for VOCs. The results of this sampling showed that CVOC concentrations did not decrease or increase with distance from the fractures, which indicates that:

- CVOCs have diffused throughout the rock matrix; and
- CVOCs in the rock matrix are not currently diffusing from the rock matrix back into the groundwater in the fracture flow network.

Groundwater CVOC concentrations within the fractures and within the rock matrix, expressed in ug/l of water, are of the same order of magnitude. This suggests that CVOCs can enter the rock matrix and act as a long-term source of groundwater contamination. In the LTR source, these results support the conceptual model, which was proposed by RMT, that waste solvents in the source areas migrated downward through fractures and also migrated into the rock matrix, which will act as a long term source of CVOCs to the groundwater through diffusion from the matrix into the fracture groundwater. At the LTR boundary where CVOCs are at a lower concentration, if the continued CVOC migration from the LTR source area stops or is prevented and CVOCs are removed from the groundwater, back diffusion of VOCs from the rock matrix would maintain a VOC plume although at a much lower concentration than current levels.

The bedrock investigation identified a variable and sometime large porosity in the bedrock matrix, but the investigation did not identify any clear large-scale flow features. Hydraulic conductivities measured over discrete intervals in the boreholes were generally low. The bedrock aquifer appears to be massive and very low in hydraulic conductivity below the eastern part of LTR. The low hydraulic conductivities measured at B-1 (2×10^{-6} to 2×10^{-4} cm/s) are consistent with low yielding wells EW-6D (hydraulic conductivity = 2×10^{-4} cm/s), EW-8D and EW-9D, and the limited hydraulic conductivities previously measured at RM-304D (3×10^{-4} cm/s) and RM-209D (10^{-4} cm/s). Groundwater flow also appears to be limited at RM-213 based on the hydraulic conductivities of $8 \times 10^{-9} - 4 \times 10^{-4}$. Relatively low groundwater flow rates are expected at locations within a dolomite aquifer where the water table is substantially below the top of the bedrock because weathering decreases with depth. The top of bedrock is 20 feet or more feet below the water table in the northeast corner (B-1 and B-3) of LTR.

However, based on the following results, which combine the bedrock investigation, the earlier RI, and CVOC trends versus time, it appears that swale in the upper surface of the bedrock extending from around B-2 and RM-7 to B-5/RM-211D/EW-7 (which appears to be a continuation of the swale shown northwest of LTR in Exhibit 6) could act as a preferential flow path from LTR:

- along the northern boundary of LTR there is a local low for the elevation of the top of bedrock in the vicinity of B-2 and RM-7 (the distance of the top of the water table below the top of bedrock was less than 10 feet at B-2 and less than 5 feet at RM-7 (compared to about 30 feet at EW-1D);
- field packer tests suggest that moderate hydraulic conductivity exists at B-2 and RM-7 (generally exceeding 1×10^{-3} cm/s in shallow groundwater at B-2, 1×10^{-3}

cm/sec at 42 to 52 feet bgs and 51 to 61 feet bgs and 2 X10^{-3} cm/s at 96 to 106 feet bgs at RM-7 (see RI Table 3-8));

- the following fractures were observed in the boring for RM-7XD (see RI): a highly fractured zone was identified from 41.8 to 42.5 feet bgs; a vertical fracture at 48.8 to 50.5 feet bgs; a 70 degree fracture at 95.3 to 96.2 feet bgs; a 60 degree fracture at 96.6 to 96.9 feet bgs;
- the boring log for RM-7XXD identified a number of horizontal fractures having apertures up to 25 mm, one horizontal fracture with an aperture of 50 mm at 194 feet bgs, and a vertical fracture at 165 to 165.6 feet bgs;
- to the northwest of LTR, there are top of bedrock lows at RM-211D, EW-2, B-5, and RM-208D;
- a fracture having a measured hydraulic conductivity of 0.2 cm/sec was identified at B-5;
- at pilot boring EW-7B frequent fractures were observed, and large quantities of water were produced (pumping test results indicated that a sustainable pumping rate of over 100 gpm was possible; the geological log for EW-7D, which was installed in boring EW-7B near the southwest corner of LL, identifies fractures at 61 - 65, 68-71 feet bgs, and "very fractured 80 – 83 feet (video observation), lots of water produced."; from December 2001 through February 2003, EW-7 was pumped at 22 to 24 gpm);
- frequent horizontal and vertical fractures were observed in the boring for RM-208D;
- CVOC trends at RM-7XD indicates an impact from pumping EW-7D (see explanation under <u>CVOC Trends that could be related to Groundwater Pumping</u>, page 66).

The only information between B-2 and B-5 is from the boring and monitoring for RM-213. Although top of bedrock is relatively high at RM-213 (see Exhibit 4) and the hydraulic conductivity low, it appears advisable to perform more investigation of this potential preferential flow path.

Other significant flow features near LTR based on previous investigations include the following:

- the geological log for RM-307 on northern part of the west side of LTR describes an apparently very highly permeable material from about 8 to 55 feet bgs: "light brownish gray (10 yr 6/2) weathered dolomite weathered to extremely dense sandy gravel (GP) and gravel (GW) – rock to broken to core – rock unit" (*Remedial Action Implementation Report*, Volume II, RMT, April 1997);
- During the RI fractures were observed at 79.2 to 85.2 feet bgs and 94.3 to 96.4 feet bgs in the boring for RM-5D.

GROUNDWATER MONITORING AND MNA: In April 2006, RMT submitted *Workplan for Monitored Natural Attenuation Engineering Demonstration Project, Revision 1.* EPA approved this workplan and the start of the demonstration project in a letter dated June 15, 2006. The workplan provided for the following during a 24 month demonstration:

- continue the monitoring program for typical field parameters (pH, temperature, and conductivity), VOCs, SVOCs and metals;
- add monitoring of the following parameters to help better evaluate MNA: CO2, DO, NO3, nitrite, SO4, iron II, alkalinity, methane, ORP, chloride, ethane, ethane, total dissolved solids, TOC, TIC, and Mn;
- after performing a round of baseline sampling, cease pumping for the duration of the project, but maintain the system in a ready-to-operate condition;
- increase the sampling frequency for certain private wells and eight sentinel wells.

In addition, the groundwater sampling procedure changed to a low-flow method, rather than bailers.

The baseline sampling for the MNA study was performed in July 2006, and the official date that pumping ceased is August 1, 2006. In August 2008 after completion of the sampling under the two year MNA study, RMT submitted a plan for interim post MNA study groundwater monitoring to be in effect from the end of the MNA study until a final long-term monitoring plan is approved. The plan proposed quarterly sampling of eight sentinel wells, nine near-field wells, and the two new deep bedrock monitoring wells, and annual sampling of the remaining 34 monitoring wells, and 23 private wells. All samples would be analyzed for VOCs, and the two new deep bedrock wells would also be analyzed for MNA parameters. EPA approved this plan with the re-designation of RM-3D as a sentinel well for quarterly sampling, and semiannual instead of annual sampling of seven private wells.

Because of increasing CVOC concentrations at RM-7XD (see Exhibit 27), WDNR staff urged that deeper groundwater be monitored. On December 13, 2007 RMT submitted a supplemental workplan proposing to install deeper monitoring wells near RM-7D and near RM-208D. These new monitoring wells are now named RM-7XXD and RM-208XD. After addressing EPA and WDNR comments, RMT installed these deeper wells in September 2008, and the wells were sampled shortly thereafter. Discrete groundwater samples were collected for VOCs versus depth during installation of RM-7XXD. The top of the five-foot screen for RM-7XXD was place at 190 feet bgs to bound the VOC contamination exceeding the PALs. RM-208XD was to be screened at a depth corresponding to the screen level at RM-7XXD.

<u>Groundwater Flow and VOC Distribution:</u> In December 2008, RMT submitted the MNA Report, which presented eight rounds of groundwater monitoring data. RMT provided an update to this report dated April 17, 2009 in response to EPA and WDNR comments. Overall, the hydraulic and contaminant distribution data was not significantly different after cessation of pumping. Exhibit 5 contours the water table in the UGS where it exists and indicates that groundwater in the UGS migrates west at LL and LTR. Exhibit 7 shows contours of the bedrock aquifer potentiometric surface and indicates that groundwater in the LGS migrates north and northwest from LTR and LL. Exhibits 23 through 26 show the aerial distribution of the TCA, DCA, TCE and Cis groundwater contamination in the LGS.

The contamination originates in the bedrock unit below LTR. LL may contribute to the contamination of the LGS, but, if it does, the impact is not noticeable from the VOC distributions. In the LGS below LL, the CVOC contaminated groundwater migrates from the upper bedrock unit into the LGU across the upper bedrock's dipping upper surface. Because the extent of contamination within the two units remains coincident as the groundwater migrates down-gradient and the higher CVOC concentrations were detected in the bedrock wells (well numbers with a D), a separate plume map for the LGU has not been prepared.

Consistent with previous data, all CVOCs were detected at their highest concentrations at the northern boundary of LTR, including significant concentrations of TCA, DCA, 1,1-DCE, TCE, and Cis. The long axis of the CVOC plume appears to go from RM-7D, to RM-213D, to RM-214D/RM-208D, to RM-5D, to RM-210D, to RM-203D, with a side branches to the west to RM-101 and RM-3D. However, it is possible that the most contaminated flow path in the far down-gradient plume lies somewhat south and west of RM-210D and RM-203D. TCA, DCA, 1,1-DCE, TCE, and Cis are detected together throughout the plume as far down-gradient as RM-210, about one-mile down-gradient from LTR, and as deep vertically as RM-7XXD, which is screened at about 190 feet bgs. Except for 1,1-DCE, these CVOCs were also detected at RM-203D, situated about 1.5 mile down-gradient from LTR and near the Branch River. The CVOC contamination is bounded on the west by R-201D, RM-212D, and RM-2D; and bounded to the east by RM-4D and RM-10D. No PCE and little vinyl chloride or chloroethane were detected in the LGS either near or down-gradient from LTR during the MNA study.

Groundwater exceeding ESs for TCA (200 ug/l) and Cis (70 ug/l), and exceeding the PAL for DCA (85 ug/l) is limited to the immediate vicinity of LTR. Groundwater exceeding the PALs for TCA (40 ug/l) and Cis (7 ug/l) and the PAL and ES for TCE may extend to the Branch River, about 1.5 mile north of LTR. The down-gradient CVOC contamination is apparently bounded by the Branch River, although the degree of effectiveness of the Branch River as a hydraulic sink has not been evaluated.

The vertical extent of groundwater contamination in the deep bedrock was investigated during installation of RM-7XXD and RM-208XD, and monitoring groundwater at these locations has been initiated. Groundwater at or exceeding the PALs was detected at 190 feet bgs at RM-7XXD and at least 130 feet bgs at RM-208D. It appears that groundwater contamination at these locations migrated through fractures, including vertical fractures from LTR. There is no monitoring in the deep bedrock at other locations, including farther down-gradient and to the west where private wells are located.

Immediate impacts of cessation of pumping (see Exhibit 27): Because of the distance from the pumping wells to monitoring wells where water level measurements were taken and because of seasonal variations in water levels, an impact of the pump-and-treat shut-down was not discernable from water level data. However, changes in CVOC data apparently related to cessation of the pumping, indicates that the cessation may have impacted groundwater flow directions at RM-307D; RM-211D; and RM-208D. Note that the sampling method changed from bailer to low-flow at the start of the MNA study, and this change in sampling method may be the cause of some of the observed changes.

CVOC Trends and Groundwater Movement in Source Area (see Exhibits 27 and 33[14]): For LTR source area pumping wells (EW-1D, EW-6D, EW-7D, EW-8D, and EW-9D) no clear decrease in CVOC concentrations is apparent from the VOC Concentration Trend plots). In contrast, CVOCs have been increasing at RM-7D and RM-7XD. Other LTR source area monitoring wells show some increasing and some decreasing trends (see trends for RM-209D, RM-303D, and RM-307D). Some source area monitoring well trends suggest that, along certain flow paths, there has been a decrease in source area strength and greater parent compound degradation. However, relatively constant concentrations in the pumping wells, indicates that these decreasing trends do not exist in the most productive parts of the aquifer near LTR, and overall, the data do not indicate a reduction in CVOCs migrating from the LTR source area. There appears to be seasonal variation in CVOC concentrations at RM-303D possibly indicating the effect of recharge.

The relatively constant source area groundwater CVOC concentrations indicate that both the source strength and amount of groundwater flowing through the source have remained constant. This is consistent with RMT's understanding of the disposal operations and conceptual model.[15] According to RMT, residual DNAPL and the rock matrix store a large source of CVOCs that will only be very gradually be reduced by movement into groundwater moving through the LGS. Because much of the waste

14 Note that the VOC Concentration Trends charts plot data from 1997 through 2009, while the Sen slope statistical analyses utilized data from 1997 through 2008.

15 In the 2004 *Assessment of Remedial Action Effectiveness* (p. 10 – 11), RMT theorized the following: "The liquids that were dumped or leaked into the trenches infiltrated relatively rapidly into the subsurface. The solvent content of the waste liquids was sufficiently high that the solvents moved into the subsurface as relatively large 'pulse loadings' of dense nonaqueous-phase liquids (DNAPL). The primary solvents (DNAPLs) of interest, TCE, TCA and PCE, are all considerably dense than water. After entering the subsurface , the DNAPL continued to migrate, primarily vertically, through the unsaturated LGU deposits and into the fractured limestone bedrock above the groundwater table in the LGS. The DNAPL continued to move downward through the interconnected fracture network in the saturated bedrock. Sufficient DNAPL mass was released from the water dumping events to allow a continuous vertical column of DNAPL to form in the major fractures, which provided sufficient static head pressure to enable the DNAPL to overcome pore pressures in the fractures within the capillary zone above the groundwater table and to enter the water-saturated bedrock. The DNAPL then continued downward, moving deeper into the saturated bedrock, until lateral dispersion of DNAPL into the fracture network caused the continuous vertical DNAPL column to separate, at which point the static head pressure at the advancing front of the DNAPL could not overcome the capillary pressures within the water-saturated fracture, and the DNAPL ceased moving downward into the bedrock.".

entered the bedrock aquifer prior to construction of the site cover and the primary contaminant release mechanism is through movement of groundwater contacting the DNAPL or bedrock porous matrix, the site cover did little to reduce movement of contaminants from LTR because contaminant release results primarily from movement of groundwater contacting the CVOCs in the DNAPL or within the bedrock porous matrix (see Exhibit 34). This is consistent with RMT's conclusion that "the composite type cap on the LTR likely provides only limited reduction of further release of VOCs into the subsurface and groundwater beneath the site, relative to the quantity of VOC source mass that has already migrated into the fractured bedrock many years ago" (Assessment , p. 15).

Groundwater flow is primarily horizontal, likely including flow along the top of the bedrock migrating through LTR from the southwest. However, detection of CVOCs at 190 feet bgs at RM-7XXD indicates that there are vertical fractures below the disposal area and that the interconnected fracture network extends vertically to at least 190 feet bgs and CVOC detections at RM-208XD indicate that the interconnected network extends horizontally for at least 2000 ft.

<u>CVOC Trends that could be related to Groundwater Pumping (see Exhibits 27 and 33):</u> *The timing for expecting changes in down-gradient concentrations in response to the* cessation of pumping cannot be approximated at all locations because hydraulic conductivities are highly variable and because preferential flow paths exist. Therefore, groundwater travel times may vary widely. Immediate changes in concentrations are not likely except at monitoring wells very near or connected by a preferential pathway to a pumping well. The intact dolomite bedrock has very low hydraulic conductivity, but fractures with greater hydraulic conductivity exist. Some data indicate that an average CVOC velocity in groundwater of 600 feet per year can be expected along the major flow path.[16] Therefore, the estimated average distance CVOC groundwater contamination traveled along this path during the 3+ years between the start of the MNA study (August 2006) and the last reported sampling event (December 2009) is 2000 ft. Pumping rates from source area wells decreased substantially before the shut-down, and, for that reason, a detected impact could be related to this reduction in pumping rather than the ultimate cessation of pumping.

With this in mind, there is a possibility that the following are changes in CVOC concentrations versus date, are related to pumping, decrease, and then cessation of pumping:

- Decreasing trends in TCA and DCA at RM-3I, from 1997 to 2006 appear to reverse during 2006 to 2009;
- Decreasing trends in CVOCs at RM-005I, RM-005D, RM-103D, RM-204D,

16 LTR operated from 1970 to 1976, but most of the documented waste disposal occurred from 1974 to 1976. Assuming that VOCs started leaching into the bedrock aquifer in 1972, and knowing that VOCs were detected in residential wells about 8,000 feet down-gradient from LTR in 1985, the average CVOC velocity can be estimated to be 600 ft/yr.

RM204I, RM-210I from 1997 to 2005 or 2006, appear to stabilize thereafter;
- After no CVOCs were detected at RM-002I from 2005 to 2007, low concentrations of TCA, DCA, TCE, Cis, and 1,1-DCE were detected in 2008 and 2009.

Overall, the CVOC trends indicate that the pump-and-treat system was partially effective in capturing or diverting groundwater contamination. The trends at RM-3I and the jump in concentration at RM-211D probably resulted from cessation of pumping at EW-2D and possibly EW-7D, and suggest that more CVOCs are migrating west and northwest in that area since cessation of pumping. The decreasing trends at RM-005I, RM-005D, RM-103D, RM-204D, RM-204I, and RM-210I appear to be related to operation of the source area pumping wells, and the stabilization of concentrations to cessation of pumping. Trends in CVOCs at RM-2I could indicate that groundwater pumping (probably at EW-4I and EW-4D) diverted CVOC contaminated groundwater from that area and that, since cessation of pumping, CVOC contaminated groundwater is again migrating into that vicinity.

Following are trends observed in LTR source area up-gradient and side-gradient wells:
- Decreasing trends at RM-101D;
- An increase and then a gradual decrease in TCA at RM-304D;
- A gradual decrease in TCA at RM-305D;
- A decrease in CVOCs (other than DCA) at RM-306D since approximately 2001.

These decreasing trends could indicate that CVOC contamination that was spread in all directions from the disposal area during the disposal phase when the disposal area was a high recharge area causing a hydraulic mound, is gradually attenuating because the site cover has reduced recharge through the disposal areas. As a result, groundwater migration from LTR disposal areas is primarily along regional groundwater flow paths. This transition could also explain the general narrowing of the groundwater contamination, and continuing decreasing trends in CVOC concentrations observed at possibly side-gradient well RM-008D.

At RM-7XD, CVOC concentrations were stable from 1997 to 2001, but show a clearly increasing trend from 2002 to 2006 during pumping of EW-7D. The trend appears to reduce somewhat when the pumping rate from EW-7D decreased from 2003 to 2006. RMT stated that increasing CVOC trends after initiation of pumping at RM-7XD may be caused by small changes in the CVOC flow paths induced by the onset of pumping that resulted in a more concentrated flow line being intercepted by the monitoring well (*Assessment*, p. 33). The only new well that was pumped at a significant rate from 2002 to 2006 was EW-7D, and the screen elevations of RM-7XD and EW-7D overlap. The simplest interpretation of the CVOC trends is consistent with the general conceptual site model that long distance transport in the bedrock below the upper, highly weathered zone is mostly through essentially horizontal bedding planes, while vertical fractures under LTR is the pathway for vertical migration. These trends were not observed at other monitoring wells because they were not screened at the right depth. The implication of these trends is that the bedrock below the highly weathered zone can be pumped to effect.

In-situ Degradation of CVOCs: In-situ degradation can also have a significant impact on CVOC concentrations and trends in those concentrations. Because of the depth of the contamination, volatilization is not expected to be significant for the remaining CVOCs. Important degradation processes include biologically mediated reductive dechlorination, aerobic biodegradation, and abiotic degradation. Biologically mediated reductive dechlorination can convert PCE, TCE and TCA to less chlorinated CVOCs, including DCA from TCA, and Cis and vinyl chloride from PCE and TCE. EPA suggests the following parameter ranges indicate favorable conditions for reductive dechlorination: DO < 0.5 mg/l; ORP < -100 mV; NO3 < 1.0 mg/l; SO4 < 20 mg/l; total organic carbon > 20 mg/l; ferrous Fe > 1.0 mg/l; and methane > 0.5 mg/l (*Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water*, EPA/600/R-98/128, September 1998, p. 29). Cis, vinyl chloride, and DCA can degrade aerobically, but, TCA, PCE and TCE cannot (except by cometabolism, which occurs coincidentally with aerobic degradation of other organic compounds). 1,1-DCE can be a product of abiotic degradation of TCA.

The table on the following page summarizes data from the MNA Report that is helpful for evaluating attenuation mechanisms for this project (data is either the range or an average of the nine sampling events during the MNA study data (except for RM-213D only the July 2008 data is used because of the significant jump in concentrations).

In general, it appears that groundwater near LTR and down-gradient contain similar ratios of DCA and 1,1-DCE to TCA, Cis / TCE, and TCE / TCA with the following possible exceptions (more than 2 times ratio in LTR source area wells): at RM-214D there is a higher Cis / TCE and TCE / TCA; at RM-7XD there is a higher 1,1-DCE / TCA and TCE / TCA; at RM-7XXD there is a higher DCA / TCA and Cis / TCE; and at RM-208XD there is a higher 1,1-DCE / TCA.

DO and NO_3 appear to be lower at the LTR boundary and at RM-214D compared to upgradient from LTR. DO > 1 mg/l at the LTR boundary and downgradent except at RM-214D, RM204D and RM-210D. ORP exceeded 50 mV at all monitoring points. The low DO at far down-gradient wells RM-204D and RM-210D is comparable to low DO in groundwater at unaffected wells such as at RM-212D and RM-202D. TIC and CO_2 at LTR boundary wells and RM-214D appear to exceed levels at upgradient wells, but farther down-gradient, TIC and CO_2 cannot be distinguished from unaffected wells. TOC is low throughout the LGS, but is somewhat higher at RM-303D and RM-214D compared to other zones. Dissolved Fe is low at all LGS wells. The only LGS groundwater that had clearly lower SO_4 compared to background was at RM-7XD, which also had lower NO_3, but DO was high. The only LGS groundwater that clearly had elevated dissolved Mn is at RM-214D. The elevated dissolved Mn, and relatively

Table 8: COMPARISON OF PARAMETERS DURING MNA STUDY PERIOD (ND = not detected where detection limits were not available to the RPM)

LOCATION (RM-)	TOC (mg/l)	DO (mg/l)	ORP (mv)	DCA/TCA	11DCE/TCA	Cis/TCE	TCE/TCA	NO3 (mg/l)	Mn (mg/l)	Fe (mg/l)	SO4 (mg/l)
Upgradient (102D, 305D)	<1.4 – 3.6	5.6 – 9.8	215– 330	ND	ND	ND	ND	4.4 -11	1.1-11	<0.0046 – 0.21	3.4 - 87[17]
LTR boundary (7D,209D, 303D)	<0.72 – 3.9	1.12 – 4.22[18]	179- 351	0.46 - 0.77[19]	0.046– 0.067	2.46– 3.3[20]	0.043 - 0.11[21]	0.58 – 4.3	0.32 - 57.2	0.0046 – 0.450	32–76
Between 7D / 208D (213D)	<1.4	5.22	311	0.26	0.049	2.26	0.08	15.2	8.1 -37	0.0289	47.7
Near LL (214D)	<1.4 – 3.3	0.1 - 5.9	87 – 337	0.47	0.07	7.2	0.22	0.69 – 1.7	140 - 220	0.022 – 0.64	76–98
Down-gradient west plume (3D)	<1.4	2.48 – 3.21	167 - 319	0.39	0.08	2.1	0.089	3.9 – 5.6	0.25 - 4.3	<0.0046 - 0.24[22]	27–30
Mid-down gradient north plume (5D)	<1.4 – 0.76	1.42 – 1.81	202 - 294	0.55	0.12	2.6	0.13	6.5 -7.6	0.44 - 4.8	<.0046 - 0.49	27–30
Mid-down gradient north plume (103D)	<0.72 – 1.7	2.25 – 5.47	148 - 310	0.40	0.10	2.3	0.10	3.9 – 5.6	0.75 - 5.8	0.089 – 0.36	27–30
Mid-down gradient north plume (204D)	<0.72 – 0.91	0.13 – 0.67	103 - 280	0.4	0.067	1.4	0.067	3.1-3.9	2.7 -16	0.15- 0.23	23-29
Far-down gradient north plume (210D)	<0.72 – 1.8	0.35 – 1.47	235 - 302	0.52	0.10	1.7	0.18	2.8 – 3.7	12 - 20.6	0.0066 – 0.33	24-28
Deeper near LTR (7XD)	<1.4	5.03 – 5.86[22]	189 - 350	0.57	0.21	2.9	0.26	0.48 - 0.77	0.32- 2.1	<4.6 -940	4.5 – 7.5
Deepest near LTR (7XXD)				0.84 – 1.5	0.067	4.6 – 7.7	.037– .065				
Deepest near LL (208XD)				0.55	1.7						
Shallow aquifer 302S	6.6 -14.1	0.11- .36[22]	88-313	ND	ND	ND	ND	1.1 -1.4	73.8 – 105	0.023 – 0.26	18.8-46

17 The ranges were 3.4 to 8.9 ug/l for RM-102D, and 62 to 87 ug/l for RM-305D for the nine samples collected for the MNA study.
18 Highest and lowest value for RM-7D, and highest value for RM-303D were rejected.
19 Ratios of the average for the 9 samples collected for the MNA study were 0.46 at RM-209D, 0.66 at RM-7D, and 0.77 at RM-303D.
20 Ratios of the average from the 9 samples were 2.46 for RM-209D, 3.1 for RM-303D, and 3.3 for RM-7D.
21 The TCE/TCA ratios were: RM-7D, 0.062; RM-209D, 0.043; RM-303D, 0.11.
22 The highest detection was rejected.

low DO, ORP, and NO_3 at RM-214D is similar to the groundwater data from RM-302S, which is a UGS well located near shallow bedrock and an area of leakage in the LL slurry wall.

To help in evaluating this data, the three environment types defined in the following guidance document can be used: *Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents,* Air Force Center of Environmental Excellence, Naval Facilities Engineering Service Center, and Environmental Security Technology Certification Program, August 2004, pp. 3-6 through 3-8. These environment types are defined as follows:

- *Type 1 Environment, Groundwater Systems that are Highly Anaerobic due to High Levels of Organic Carbon*: A Type 1 environment is characterized by highly anaerobic conditions caused by biodegradation of organic material. Sulfate reduction and methanogenesis predominate. The geochemistry is characterized by: relatively high organic carbon; very low DO (less than 0.5 mg/l); ORP < -100 mV; reduced NO_3 and SO_4; and elevated Mn, Fe and methane. A Type 1 environment may result in rapid and extensive dechlorination of PCE, TCE, and TCA; and 1,1-DCA, Cis and vinyl chloride are likely to further dechlorinate.
- *Type 2 Environment, Groundwater Systems that are Mildly Anaerobic due to Moderate Levels of Organic Carbon*: A Type 2 environment is characterized by mildly anaerobic conditions, in which nitrate, manganese and iron reduction predominate, but there is not widespread sulfate reduction or methanogenisis. The geochemistry is characterized by: moderate organic carbon; -100 mV < ORP < 50 mV; reduced NO_3; and increased Mn and Fe. A Type 2 environment generally results in slower dechlorination of TCA, PCE and TCE, and incomplete dechlorination of DCA, Cis, and vinyl chloride. DCA, Cis, and vinyl chloride may accumulate.
- *Type 3 Environment, Aerobic Systems with Low Levels of Organic Carbon*: A Type 3 environment is well-oxygenated with little or no organic matter. The geochemistry is characterized by: DO greater than 1.0 mg/l; ORP > 50 mV; low organic carbon; no indication of reduced NO_3 or SO_4 ; and no indication of increased Mn, Fe or methane. A Type 3 environment will not support anaerobic dechlorination; TCA, PCE and TCE will not degrade by biological processes; and very long dissolved-phase VOC plumes are more likely to form. Vinyl chloride may rapidly oxidize.

Overall, the LGS from the LTR site boundary to down-gradient monitoring wells fits the description of Type 3 environment described in *Principles.* As a result: there is little degradation of TCE and TCA; a very long CVOC plume has formed; and vinyl chloride that was formerly present has not been detected in recent sampling events. Data that indicates that the LGS is primary a Type 3 environment, include: throughout the LGS TOC is low, ORP > 50 mV, SO_4 is not reduced and Fe is low; and with exceptions DO >

1 mg/l, NO_3 is not reduced, and Mn is not increased. Although DO is less than 1 mg/l at RM-204D and RM-210D, groundwater at these locations is still Type 3 for the following reasons: TOC is low; ORP is relatively high; and compared to up-gradient groundwater NO_3 is not reduced, Mn is not increased, and DCA/TCA and Cis/TCE ratios are similar to ratios in up-gradient groundwater. Although groundwater at the down-gradient boundary of LTR may have reduced NO_3, and increased Mn and carbon dioxide compared to background, and Cis and DCA are present, groundwater at the down-gradient boundary of LTR is still Type 3 for the following reasons: TOC is low; DO exceeds 1 mg/l; and ORP exceeds 50 mV. Based on this data, it is apparent that the reduced NO_3, increased Mn and carbon dioxide, and the presence of Cis and DCA at the LTR boundary is a result of reductive chlorination occurring up-gradient closer to the disposal areas.

Groundwater at RM-214D appears to be an exception. Groundwater at RM-214D could be considered a mild Type 2 environment for the following reasons: DO < 1 mg/l; vinyl chloride was detected; and compared to upgradient groundwater NO_3 is reduced, Mn is increased, and the Cis / TCA ratio is higher. Therefore, It appears that some further reductive dechlorination is occurring down-gradient from the LTR site boundary and upgradient or in the vicinity of from RM-214D.

RMT plotted the ratios of DCA/TCA and Cis/TCE versus date in their April 17, 2009 submittal. In general, the following trends were detected: a gradual increase in the DCA/TCA ratios at LTR source area wells and a gradual decrease in Cis/TCE ratios at down-gradient wells (see Exhibit 35). However, some of the trends identified by RMT are probably not significant.

Based on this data, EPA proposes following conceptual model for site conditions:

- Upgradient from LTR shallow bedrock fractures are recharged with highly aerobic infiltration from precipitation creating a Type 3 environment.[23]
- Within and below the disposal area, zones of free product, free product mixed with wood tar distillates and other wastes, and high concentrations of dissolved CVOCs formed. Migration of DNAPL through fractures, which were exposed when disposal trenches were created, resulted in the presence of source above and below the water table. CVOCs diffused into the bedrock matrix. All of these conditions provide a potential source of long-term CVOC contamination of the groundwater.
- Below the water table within and near the disposal zones, reductive dechlorination of CVOCs occurs because conditions develop that are favorable

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23 Bedrock is present very close to the surface at the site, and to the east, west and south of the site. During the April 7, 2010 inspection by EPA and WDNR, it was observed that perhaps 250 feet of land east of LTR and 1000 feet of land south of LTR drain towards LTR. The LTR is sloped to direct drainage from these areas away from the site cover, and around the west side of the site. Much of the site cover drains to the west into an infiltration basin that protrudes into the site on the west side (see Exhibit 36). It is likely that all this drainage with bedrock near the surface results in a large amount of aerobic infiltration upgradient and in the immediate vicinity of the site.

to the organisms that perform this reaction. First, large amounts of wood tar distillates and other organic wastes disposed at LTR stimulated biological activity, which generated CO_2, TIC, and reduced DO, the effects of which are detected in LTR northern boundary wells. This biological activity results in formation of a highly anaerobic Type 1 environment, which provides conditions for growth of bacteria that gain energy from NO_3 reduction; Fe reduction; SO_4 reduction; and reductive dechlorination of CVOCs. The reductive dechlorination results in: converting essentially all of the PCE to TCE, converting much of the TCE to Cis, and converting much of the TCA to DCA. In addition, some 1,1-DCE is formed by abiotic decomposition of TCA. The relatively steady CVOC concentrations, and gradually increasing DCA/TCA and Cis/TCE ratios at the LTR northern boundary wells indicates both that the source strength has been steady and that the conditions supportive of partial, but not complete, reductive dechlorination of TCA, PCE and TCE remain favorable. Although is it not certain to what extent these conditions will continue in the future, the waste inventory (Exhibit 10) indicates that there is likely to be a large reservoir of organic contaminants that could continue to induce highly anaerobic conditions within and near the LTR disposal zone in the future.

- When the groundwater-borne contaminants within and near the disposal zones migrate from the disposal area, they enter the Type 3 environment of the upgradient groundwater, which halts the reductive dechlorination.
- Between the disposal zones and the LTR site boundary wells, the Type 3 conditions stimulate aerobic biodegradation of the most easily metabolized organics (apparently including all of the BETX compounds) reducing DO (but not to below 1 mg/l), and increasing CO_2. The lowered DO and elevated CO_2 is detected at the LTR boundary wells. Any dissolved Fe from the disposal zone would also be precipitated by the aerobic conditions, which would explain the low Fe at the LTR source boundary wells.
- CVOCs migrate down-gradient from the LTR disposal zones attenuating primarily by sorption, infiltration, and dispersion with little biodegradation of the remaining CVOCs because conditions are not favorable for either reductive dechlorination or rapid aerobic degradation of Cis, DCA, or 1,1-DCE. This would explain why the CVOC concentrations and ratios are relatively consistent from the boundary of LTR to RM-210D.
- Because farther down-gradient groundwater data appear to be more consistent with data from LTR source area wells along with RM-213D and RM-208D rather than RM-214D or RM-208XD, it appears that RM-214D and RM-208XD are not located along the major groundwater contaminant migration pathway. This is expected because the screened interval at these wells is considerably below the top of bedrock and generally fracturing decreases versus depth. At RM-214D, the anaerobic conditions, elevated vinyl chloride, and elevated Cis/TCE are also consistent with, though not proof of, an impact from recharge from LL.
- The gradual decrease in the Cis/TCE ratios between LTR and down-gradient wells appears to indicate that limited aerobic degradation of Cis occurs in this

area, and the decrease in Cis/TCE versus time at down-gradient wells (Exhibit 35) suggests that this degradation is gradually increasing. Note that degradation of CVOCs present in the ug/l range of concentrations would not show an impact on CO_2, which are expressed in mg/l. Therefore, variations in CO_2 and TIC down-gradient from RM-214D could only be from background conditions, or degradation of other organic compounds, including organics that may be migrating from LL.

- As would be expected based on evaluation of groundwater flow, the migration pathway from the LTR disposal area to RM-7XD and RM-7XXD is not through upper bedrock boundary wells (RM-7D, RM-209D, RM-303D). RM-7XD has lower NO_3 and SO_4 concentrations, more TCE relative to TCA, and more 1,1-DCE relative to TCA compared to the boundary wells. It is unclear whether the lower NO_3 and SO_4 resulted from anaerobic degradation of LTR wastes, or lower background concentrations for groundwater at these deeper wells. In either case, the high DO indicates that anaerobic degradation is not occurring in groundwater at these wells. Compared to groundwater at RM-7XD, groundwater at RM-7XXD has relatively less TCE, less 1,1-DCE, more Cis, and more DCA. This could indicate either that groundwater at RM-7XXD migrates from RM-7XD and CVOCs degrade along that pathway, or that there is a separate more anaerobic flowpath from LTR to RM-7XXD.

COMPARISON OF NON-VOCS WITH PALs AND ESs: Compared to previous groundwater data, dissolved metals were detected at lower concentrations during the MNA study possibly because the change to the low flow sampling method. Dissolved nickel continued to be detected at concentrations exceeding the ES (100 ug/l) in the LGS up-gradient from LTR at RM-305D (57 to 120 ug/l, compared to 100 to 1,200 during previous sampling). Dissolved nickel was not detected exceeding the PAL (20 ug/l) at RM-7D (previously detected at up to 860 ug/l), but it was detected at from 12.6 to 27 ug/l in RM-303D in the LGS down-gradient from LTR. Dissolved nickel continued to be detected exceeding the PAL in the UGS near LL at RM301S (12.6 to 27 ug/l). Dissolved nickel was also detected exceeding the ES/PAL in a number of background wells (RM-004D, 21.6 to 110 ug/l; RM-004S, 260 ug/l; RM-11D (23.7 to 230 ug/l); RM-212D, 4.1 to 86 ug/l). None of the samples exceeded the PALs for antimony or thallium.

As illustrated in Exhibit 22 and as previously described in the Data Quality section, BEHP was detected exceeding its ES in groundwater from seven of the sentinel wells. It is believed that these detections were caused by laboratory contamination.

There was a trace detection of lindane in down-gradient pumping well EW-6 (0.024 ug/l compared to the PAL of 0.02 ug/l).

EVALUATION OF SOURCE AREA TREATMENT / CONTAINMENT ALTERNATIVES: Following is a comparison of site conditions to EPA expectations, from OSWER 9200/4-7P (EPA, April 21, 1999). This comparison indicates that it would not be appropriate for EPA to accept MNA as the major component of the groundwater cleanup remedy at

LL/LTR without attempting to accelerate groundwater cleanup using pump-and-treat or some other technology.

1. "When relying on natural attenuation processes for site remediation, EPA prefers those processes that degrade or destroy contaminants": Outside of the LTR disposal zone biodegradation is limited and reductions in concentrations are primarily the result of processes that physically dilute contaminants.

2. "EPA generally expects that MNA will only be appropriate for sites that have a low potential for contaminant migration": CVOC contamination has migrated at least 1.5 miles down-gradient from LTR, and in the past affected residential wells. The existing plume appears to be relatively stable, although there appear to have been some shifts in position as a result of turning off the extraction wells, and there are limited data on the plume behavior at depth.

3. "MNA is appropriate as a remedial approach where it can be demonstrated capable of achieving a site's remediation objectives within a timeframe that is reasonable compared to that offered by other methods and where it meets the applicable remedy selection criteria (if any) for the particular OSWER program.": Natural attenuation is not expected to result in cleanup of the groundwater contamination from LTR in any reasonable amount of time for the following reasons:

- Our information on disposal quantities, how disposal occurred, conditions within the disposal area, and data from source area groundwater monitoring indicate that CVOC releases from will continue at about the same rate for a very long period of time;
- biodegradation of CVOCs outside the LTR disposal zone is very limited; and
- the gradual decreases in CVOCs at a number of down-gradient wells appears to have stabilized since discontinuation of pumping.

If the LTR source area is controlled through an effective pump-and-treat design or some other technology, the down-gradient groundwater would be cleaned up much sooner. The groundwater modeling report predicted that if the source area is contained, that CVOC concentrations would be substantially reduced within 15 years (*Groundwater Modeling Report and Plan for Recovery System Enhancements*, RMT, September 2000, p. 12). This prediction is reasonable for the down-gradient plume area, where the pumping rates achieved agreed with the model.

4. "...in some complex geological systems, technological limitations may preclude adequate monitoring of a natural attenuation remedy to ensure with a high degree of confidence that potential receptors will not be impacted.": It does not appear to be possible to locate sentinel wells that would provide a reliable early warning of CVOC contamination approaching each private well for the following reasons:

- in the down-gradient plume area, although the known contamination is present at a much shallower depth than the depth of the residential well screens (mostly 250 feet bgs), a number of residences are within or near the aerial extent of the groundwater contamination;

- the fracture network is undefined and would be impractical to define especially in deep bedrock;
- each well cannot be guaranteed to sample portions of the fracture network that are representative of major flow paths or of a flow path to a private well;
- most of the private wells are installed at 250 feet bgs or below and at these depths characterization is especially difficult and expensive.

Nonetheless, it appears that adequate monitoring of the deep bedrock is technologically achievable. It is expected that the LGS is the major contaminant flow pathway, and the most likely migration pathways in the LGS have been identified and are being adequately monitored. Private well sampling is ongoing, and there can be a response to any LL or LTR related contamination that exceeds PALs or otherwise presents an unacceptable risk. Even though the lower bedrock groundwater is only being monitored at RM-7XD, RM-7XXD, and RM-208XD, there is a lot of uncertainty about the amount of contaminant migration in the lower bedrock because usually groundwater flow is much reduced in deeper bedrock, where there are usually fewer fractures.

OSWER 9200/4-7P also states: "**EPA expects that MNA will be most appropriate when used in conjunction with other remediation measures (e.g., source control, groundwater extraction), or as a follow-up to active remediation measures that have already been implemented.**" The groundwater data indicates that the source control measures for LL (cap, slurry wall, and leachate withdrawal) have been quite effective even though all design objectives were not achieved. On the other hand, source control measures for LTR (removal of near-surface containerized wastes, cap, SVE considered but screened out) have not resulted in a general reduction in the groundwater contamination. This result is not unexpected considering the quantity of wastes disposed, how wastes were disposed and conditions in the disposal area (see RMT's conceptual disposal model in *Assessment)*. For this reason, EPA expects further source control measures to be attempted and implemented.

In March 2009, RMT submitted *Summary of Groundwater Pump-and-Treat Remedy and Evaluation of Source Control Alternatives.* In this report, RMT reiterated a statement first made in the 2004 *Assessment of Remedial Action Effectiveness* that modeling indicates that 90% of the VOCs were removed by natural attenuation processes. This model was never approved for contaminant modeling by EPA or WDNR. Agency reviewers are skeptical of the model results because the model is basically the same model that far over predicted the achievable pumping rates from wells near LTR. As a result, the model is not likely to predict contaminant fate or transport with reasonable accuracy. Considering the variability of aquifer conditions, at this time technical staff believe that it would be better to perform additional monitoring and source control than to allocate resources in an attempt to model the contaminant fate and transport from LTR and LL.

Relative to operation of the existing (currently not operated) pump-and-treat system, it is clear that the reason that had such limited effectiveness was because a substantial amount of highly contaminated LTR source area groundwater was not being captured by the pump-and-treat system. The reason that source area wells were not pumped near the design rates was primarily because the hydrogeological characteristics in this area and up-gradient were much different than modeled. It is also possible that pumping rates could have been increased somewhat with improved well maintenance.

Following review of the March 2009 *Assessment* report, agency reviewers requested further evaluation of hydraulic containment of the source areas by pump-and-treat. In response, RMT submitted a hydraulic containment assessment dated May 29, 2009, and a *Pumping Test Workplan to Support Site Conceptual Model of Plume Containment*, RMT, November 2009. In a February 11, 2010 letter, EPA requested that the evaluation be expanded to include: consideration of the importance of vertical fractures and attempting to intercept these fractures through use of directional or angle drilling; use of permeability enhancements such as hydrofracturing; and moving the containment boundary to the north where the LGS is more permeable. After a meeting on April 29, 2010, the LSRG agreed to submit an evaluation on June 28, 2010; the disposition of the Workplan will be determined after review of this document.

Site Inspection: Luanne Vanderpool and Richard Boice of EPA visited the LL and LTR sites on July 23, 2008 along with representatives of RMT and the LSRG. The primary purpose of the visit was to provide an orientation for EPA staff. During the visit the both LL and LTR site covers appeared to be well vegetated, no erosion damage was noticed, and the monitoring wells and fence that was observed appeared to be in good condition. RMT explained operation of the groundwater treatment system, which was not operating, and the leachate withdrawal.

On April 7, EPA and WDNR staff and David Dougherty of Subterranean Research, Inc. performed an on-site inspection of LL and LTR. A memorandum on the inspection comprises Exhibit 28. The groundwater treatment system and leachate collection system, although not in operation, appeared to be in good repair and ready to operate. The site covers on both sites were well sloped, and well vegetated, and only required routine ongoing monitoring and maintenance. The fence at LL appeared to be in good repair, and only routine maintenance was needed for the fence at LTR. The OMP and health and safety plan were not on the site, and, apparently, are not used, but the facilities appeared to be well maintained, and the site operator exhibited detailed knowledge of O&M.

A number of the inspectors arrived on-site with the impression, based on maps in various reports, that the entire LTR property had been capped. However, during the inspection it was observed that the southeast and southwest corners may not be capped, and that there is a holding/sedimentation pond on the west side of LTR outside the capped area that receives drainage off the site cover. For these reasons, it was requested that RMT provide a more accurate indication of the capped area of LTR on their maps (as it is for LL). In addition, it was requested that an as-built drawing of the

LTR site cover be provided. RMT provided an as-built map for the LTR site cover in a submittal dated May 17, 2010 (Exhibit 36). Significant observations from the inspection are incorporated into other sections of this report.

Interviews: Site conditions were discussed with the RMT site operator during the site visit.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents? ANSWER: NO. Problems with implementation of the remedy are listed below:

1. Data Quality: The analytical procedures for PCBs, cPAHs and pentachlorophenol in groundwater are not sensitive enough to detect these contaminants near either its MCL, PAL or RSL. It is believed that BEHP detections exceeding the ES have been caused by laboratory contamination.

2. Groundwater Monitoring to Bound the Contamination: CVOCs have migrated deeper into bedrock near LTR than was expected and may be migrating through a fracture network in the deep bedrock that is not being adequately monitored. Monitoring in the down-gradient plume area may not be along the most contaminated flow path in the LGS. The degree to which CVOC contaminated groundwater is migrating into to the Branch River is unclear. The bedrock surface contour map has not been updated since the RI even though there have been a number of additional borings.

3. Protection of Groundwater for Private Well Users: CVOC migration in the deep bedrock could result in imposing groundwater usage restrictions on a larger groundwater zone and in an impact on existing private well water. The existing sentinel wells do not provide a reliable early warning of CVOC contamination approaching each of the private wells. As a result of the cessation of pumping, the long axis of the CVOC plume appears to be shifting westward toward zones used by existing private wells. The OMP does include sampling of new private wells.

4. Protection of aquatic life in the Branch River: The quantity of CVOCs migrating into to the Branch River has not been determined. The limitations on CVOCs migrating into the Branch River that are necessary to protect aquatic life have not been defined.

5. Containment of LL leachate: The slurry wall at LL did not meet the design and ROD requirement to be keyed three feet into the clay layer primarily because of unexpected field conditions. The leachate removal does not appear to be capable of achieving the design requirement of reducing leachate head levels to one foot above the top of the clay confining unit. RMT's request to discontinue leachate withdrawal conflicts with the 1991 ROD requirements that the groundwater withdrawal must continue as long as contaminated groundwater within the slurry wall is generated, and result in an inward groundwater gradient at all points within and at the edges of the waste mass. However,

data on VOCs in the leachate appear to indicate that the threat of contamination of the UGS or LGS from release of leachate has been greatly reduced.

6. Operation Maintenance and Monitoring of the Pump and Treat System: The system has been largely ineffective in cleaning up groundwater because the LTR source area groundwater was only being partially captured. For LTR source area wells, sustainable pumping rates have always been substantially less than designed rates and less than predicted based on post-installation tests. In the past some reasonably expected actions to improve and monitor the performance of the pump-and-treat system were not taken, including: use field monitoring data to define the extent of capture and improve the monitoring network to fill data gaps; closely monitoring pumping rates; performing maintenance to maintain/increase pumping rates; and evaluating alternative pumping rates and locations and alternative technologies to improve hydraulic capture of contaminated groundwater migrating from the LTR source area. The 1991 ROD requirement to perform hydraulic monitoring to verify hydraulic performance of the groundwater pumping, including determining of the extent of the cones of depression around the pumping wells, was not performed. The groundwater model was not updated to better reflect field measurements, including achievable pumping rates and boring logs. The only reporting of pumping rates was a single typical pumping rate for each pumping well identified in the progress reports. Pumping wells were not maintained in response to a 10% reduction in specific capacity as provided for in Section 3.8.1.1 of the OMP.

7. Evaluation of Source Area Treatment / Containment Alternatives: Comparison of site conditions with EPA expectations described in OSWER 9200/4-7P indicates that it would not be appropriate, at this time, for EPA to accept MNA as the major component of the groundwater cleanup remedy at LL/LTR, and that additional efforts are needed to capture off-site migration of source area contaminants (which would accelerate distal groundwater cleanup) using pump-and-treat or some other technology. The LSRG has submitted a screening level evaluation of alternative technologies to groundwater pump-and-treat. The LSRG has committed to submitting a report to evaluate expansion and use of alternative technologies to improve the performance of the pump-and-treat system.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid? ANSWER: YES, except that no limits have been established for CVOCs migrating into the Branch River. The LL and LTR landfill caps, access restrictions, and ICs continue to address the direct contact risks from contaminated wastes and soils. There have been no documented releases to the surface soil or surface water near LL or LTR since construction was completed. Some VOCs and SVOCs were detected west of LL during the RI (see Exhibit 37, especially SD-01). It is unclear whether these contaminants originated at LL. VOC contamination in the near surface soil would have dissipated over the past twenty years since the RI sampling. SVOC detections were compared to RSLs for residential soil, and it was found that only bis(2-chloroethyl)ether exceeded a current RSL (detection = 11,000 ug/kg compared to RSL = 190 ug/kg). Bis(2-chloroethyl)ether is an unstable compound and is expected to have broken down over the 20 years since the RI sampling.

For the contaminants of concern in groundwater, in general the most stringent of the groundwater cleanup standards identified in the ROD are the PALs. Under State of Wisconsin law, the PALs are legally applicable to the cleanup of past releases of contaminants (NR 140.02(3)). Therefore, the PALs applicable to this cleanup are not frozen at the time of the ROD, but are updated whenever Wisconsin updates the PALs. The PALs are set at from 10 to 20% of the ESs (see Exhibit 38 from NR 140.10), the latter generally being equivalent to EPA's MCLs. To date there has been no request for an exemption from a PAL (NR 140.28).

For contaminants, that do not have an MCL, the RPM compared the PALs to Region 3 RSLs for tapwater, and found that the RSL is significantly more stringent only for DCA (PAL = 85 ug/l versus RSL = 2.4 ug/l). The reason that the RSL is more stringent than the PAL is because the RSL treats DCA as carcinogenic, while the PAL does not. Using the RSL's carcinogenic potency factor, drinking water exposure to DCA at the PAL concentration would result in a 3.5×10^{-5} lifetime incremental cancer risk, which is within EPA's acceptable risk range.

Toxicity data on DCA is limited. The RSL is based on a carcinogenic potency factor from a 2003 California Environmental Protection Agency report, which utilized an updated calculation method to interpret data from a 1978 bioassay. To date, this carcinogenic potency factor has not been widely accepted. The same 1978 bioassay data is included in the evaluation in EPA's Integrated Risk Information System (IRIS), and resulted in DCA being classified as a possible human carcinogen, but no carcinogenic potency factor is provided in IRIS. Many states other than California use cleanup levels in the range of 50 to 80 ug/l. The PAL is 10% of WDNR's ES, which was derived from non-carcinogenic risks using air toxicity data converted to drinking water exposure. WDNR set its ES as part of the NR 140 "Cycle 2" standard settling effort. WDNR will add DCA to its tentative list for evaluation during the next cycle ("Cycle 10").

Table 5 indicates that benzo(a)pyrene and benzo(b)fluoranthene have PALs, but benzo(a)anthracene, benzo(k)flouranthene, and indeno(1,2,3-cd)pyrene, do not have PALs. The latter three cPAHs either do not have toxicity factors identified in the ROD or the toxicity factors are out of date. To date PAHs have not been detected in groundwater. Usually a number of PAHs are detected together, but if benzo(a)anthracene, benzo(k)flouranthene, or indeno(1,2,3-cd)pyrene are detected in the absence of the other PAHs, the data can be compared to the RSLs, and updated cleanup standards considered if necessary.

No limitations on CVOC migration into to the Branch River were identified in the 1991 ROD because the pump-and-treat was supposed to prevent this. If the groundwater contamination is not going to be captured before reaching the Branch River, groundwater concentrations protective of aquatic life in the Branch River need to be derived.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy? NO. This report has addressed all information available to reviewers

Technical Assessment Summary: The LL and LTR site covers, the LL slurry wall and leachate withdrawal system, and the combined pump-and-treat system have been properly maintained (with the exception of the pumping capacity of LTR source area wells). Adequate ICs and an IC plan are in place (although the LSRG is working on a correction to a property description). The data shows that the LL site cover, slurry wall and leachate withdrawal system has been effective in reducing groundwater contamination from LL. Considering the reduced VOCs concentrations in LL leachate, EPA and WDNR need to decide whether it is acceptable to discontinue leachate withdrawal at LL. The MNA study was properly performed. The primary groundwater contaminant migration pathways, and private wells that existed at the time of the RI are being monitored, and the groundwater contamination does not appear to be expanding.

On the other hand, the LTR removal action and site cover has not resulted in an obvious reduction in groundwater contamination. The results of the MNA study indicate that MNA by itself will not result in cleanup of any significant zone of groundwater in the foreseeable future, and may not be sufficient for protection of groundwater used by private wells or for reducing the areas that need to be restricted by ICs. Comparison of site conditions with EPA expectations described in OSWER 9200/4-7P indicates that it would not be appropriate, at this time, for EPA to accept MNA as the major component of the groundwater cleanup remedy at LL/LTR, and that additional efforts are needed to capture off-site migration of source area contaminants (which would accelerate distal groundwater cleanup) using pump-and-treat or some other technology.

The pump-and-treat system had very limited effectiveness because it only partially captured groundwater contamination at the LTR source area. The data indicates that the pump-and-treat resulted in a very gradual reduction of CVOC concentrations down-gradient from LL and LTR, and in diversion of contaminated groundwater away from certain private wells. Heretofore, efforts to increase source area hydraulic capture focused on adding a small number of pumping wells that are similar in design to the existing source area pumping wells, which to date have been proven to be inadequate. While installation of a line of groundwater pumping wells near the LTR boundary should be further evaluated, alternative technologies that increase the interception of fractures by wells should also be evaluated, including directional drilling, hydraulic or pneumatic fracturing, and adjustments to the groundwater containment boundary to areas with greater groundwater productivity. EPA needs to decide whether the pump-and-treat should be restarted to protect private wells, and at least partially contain the source area groundwater contamination while further actions are being evaluated.

A number of improvements to the groundwater monitoring are needed. Improved analytical procedures may be needed for PCBs, cPAHs and pentachlorophenol to reliably determine whether they are present above MCLs, PALs and/or RSLs. Improved analytical procedures may be needed to assure that BEHP laboratory contamination is either eliminated or detected and the BEHP data properly qualified. Improvements to the groundwater monitoring network may be needed to adequately characterize the extent of CVOC contamination in down-gradient plume area, in deep bedrock, and to provide an early warning of CVOC approaching private wells. An updated bedrock surface map is needed. The monitoring plan should provide for adding sampling of new private wells installed in the area. If contaminated groundwater is going to be allowed to migrate into to the Branch River, groundwater concentrations that will be protective of aquatic life need to be established, and, if necessary, the quantity of CVOCs entering to the Branch River determined.

VIII. Issues

Table 9: Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1. Data quality (current analytical methods for PCBs, cPAHs and pentachlorophenol are not sensitive enough, and laboratory contamination is apparently causing false BEHP detections)	N	Y
2. Groundwater monitoring to bound the contamination (possibly insufficient monitoring of down-gradient plume and bedrock fracture network, and bedrock surface contour map is out of date).	N	Y
3. Protection of groundwater for private well users (may have to expand the well restriction zone, possibly insufficient sentinel wells, westward shift in down-gradient contamination, and plan does not add new private wells)	N	Y
4. Protection of aquatic life in the Branch River (CVOC groundwater concentrations protective of surface water have not been derived, and quantity of CVOCs migrating into the Branch River has not been determined)	N	Y
5. Containment of LL Leachate (proposed discontinuation of leachate withdrawal is inconsistent with ROD provisions)	N	Y
6. Operation, maintenance and monitoring of the pump-and-treat system (address deficiencies)	N	Y
7. Evaluation of LTR source area treatment / containment alternatives (need further evaluation of pump-and-treat expansion and use of alternative technologies)	N	Y

IX. Recommendations and Follow-up Actions

Table 9: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current/	Future
1	Revise the QAPP with updated standard operating procedures for analysis of PCBs, cPAHs, pentachlorophenol and BEHP in groundwater	LSRG	EPA	6/30/2011	N	Y
1,2, 3	Update the groundwater monitoring plan	LSRG	EPA	6/30/2011	N	Y
3	Establish a contingency for re-initiation of groundwater pumping	EPA		10/30/2010	N	Y
4	Establish groundwater CVOC concentrations that are protective of aquatic life in Branch Creek. If necessary, determine the rate of CVOCs migrating into Branch Creek	WDNR LSRG	EPA EPA / WDNR	12/30/2011 6/30/2011	N	Y
5	Complete review of the need for continued leachate withdrawal at LL, and issue an ESD, if necessary, in which EPA will decide whether it is protective to change certain ROD requirements relative to the slurry wall and leachate withdrawal	EPA		12/30/2010	N	Y
6, 7	Evaluate options to improve source area groundwater capture or treatment Issue an ESD, if necessary	LSRG EPA	EPA, WDNR	12/30/2010 6/30/2011	N	Y

The updated monitoring plan should be a complete stand-alone document including: proposed sampling locations; sample frequency; a plan and schedule for reporting results. The plan should include at least two rounds of groundwater sampling for PCBs, cPAHs, pentachlorophenol and BEHP using the updated analytical procedures. The contingency should be established by EPA in a letter to the LSRG and should include: closely monitoring sentinel wells representing zones where private wells are screened (such as RM-2I and RM-2D); and a schedule for re-initiation of groundwater pumping if it is confirmed that the concentration of any CVOC exceeds its PAL at one of those sentinel wells.

X. Protectiveness Statement(s)

The remedy at LL, and LTR currently protects human health and the environment for the following reasons: the site covers, fence, and institutional controls are preventing direct contact with the contaminated wastes and soil (OU #1 and OU #2); groundwater monitoring has defined the extent of the contamination along the most likely migration pathways (OU #1); private wells existing at the time of the RI are being sampled regularly (OU #1); and the State of Wisconsin regulates installation of new wells. In order for the remedy at LL and LTR to be protective in the long-term, the following actions need to be taken to improve OU #1:

- revise the Quality Assurance Project Plan with updated standard operating procedures for analysis of polychlorinated biphenyls, carcinogenic polyaromatic hydrocarbons, pentachlorophenol and bis(2-ethylhexyl)phthalate in groundwater;
- update the groundwater monitoring plan;
- establish a contingency for re-initiation of groundwater pumping;
- establish groundwater CVOC concentrations that will be protective of aquatic life in Branch Creek, and, if necessary, determine the rate of migration of CVOCs into Branch Creek;
- complete review of the need for continued leachate withdrawal at LL, and issue an ESD, if necessary, in which EPA will decide whether it is protective to change certain ROD requirements relative to the slurry wall and leachate withdrawal;
- evaluate options to improve source area groundwater capture or treatment, and issue an ESD, if necessary.

XI. Next Review

The next five-year review is scheduled to be completed within five-years of the date of this report.

Exhibit 1:

Lemberger Transport and Recycling Superfund Site

1) State

2) Manitowoc County

3) Lemberger Transport and Recycling

N

Figure 1

GEOS
Groundwater Evaluation and Optimization System

Plot created by Sarah Backhouse U.S. EPA Region 5 on 9/12/2005

Exhibit 2:

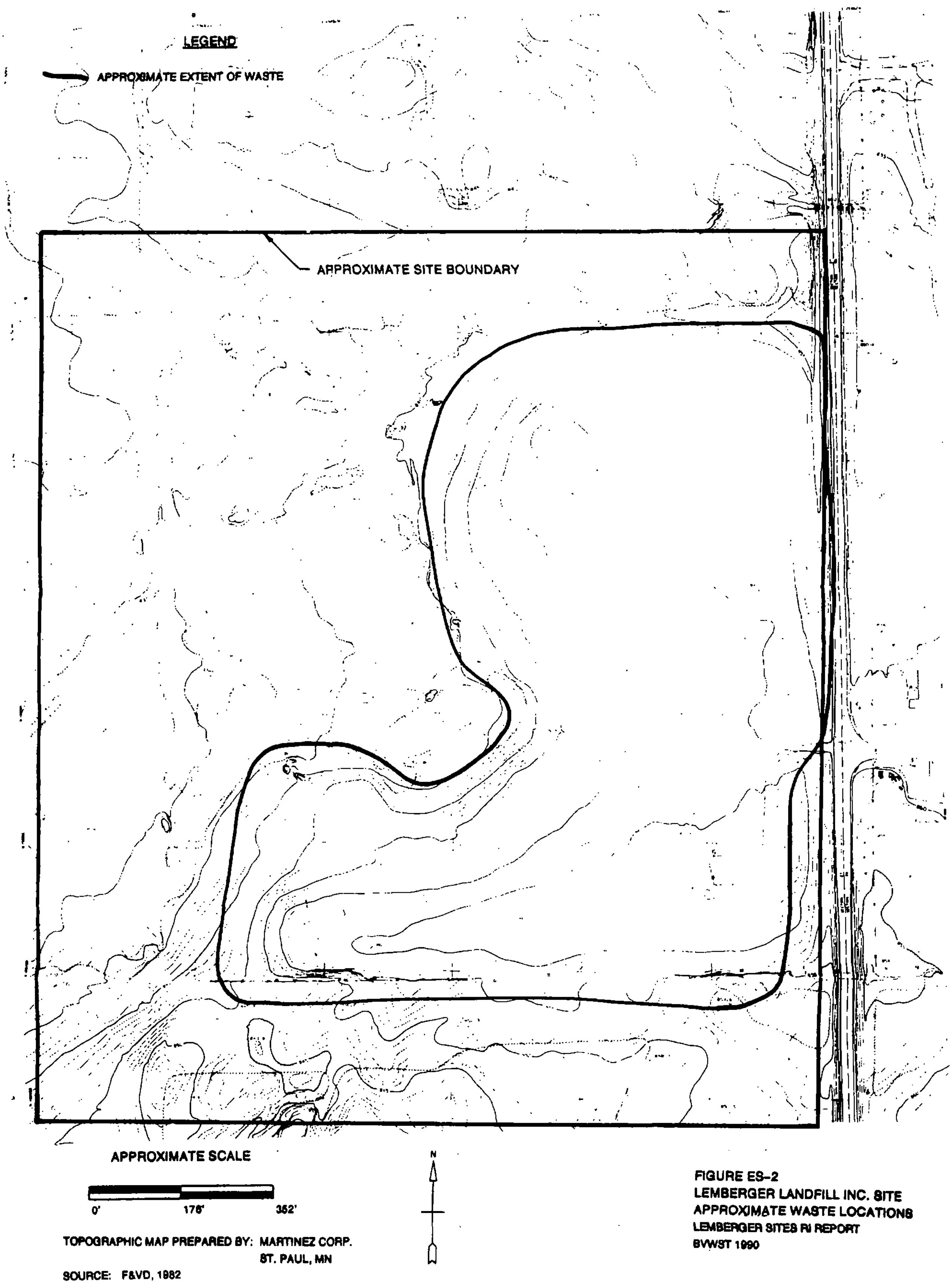
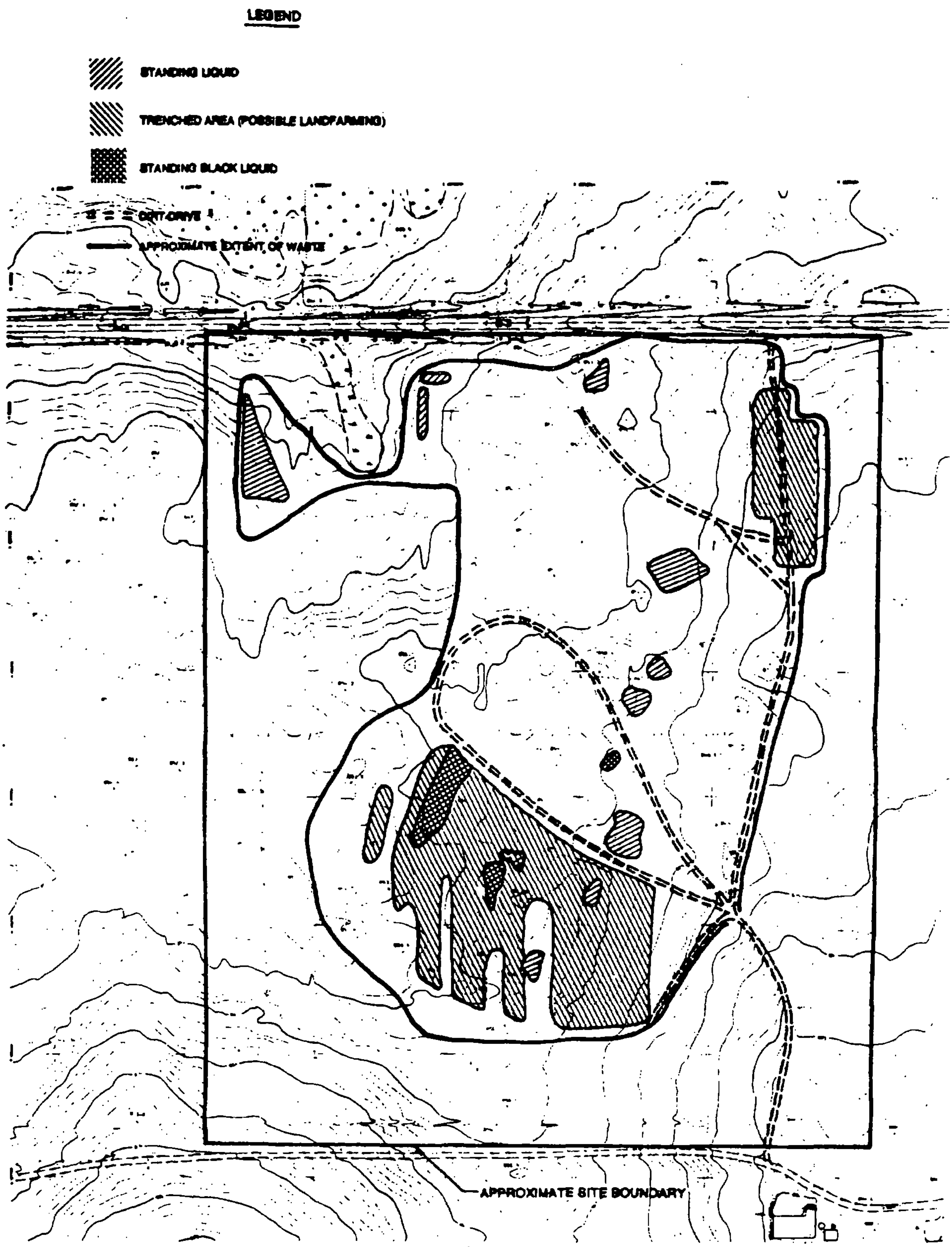


FIGURE ES-2
LEMBERGER LANDFILL INC. SITE
APPROXIMATE WASTE LOCATIONS
LEMBERGER SITES RI REPORT
BVWST 1990

Exhibit 3:



APPROXIMATE SCALE

0' 176' 352'

N

TOPOGRAPHIC MAP PREPARED BY: MARTINEZ CORP.
ST. PAUL, MN

SOURCE: COMPOSITE OF 1974, 1976 AERIAL PHOTOS

FIGURE ES-3
LEMBERGER TRANSPORT AND RECYCLING INC. SITE APPROXIMATE WASTE LOCATIONS
LEMBERGER SITES RI REPORT
SVWST 1990

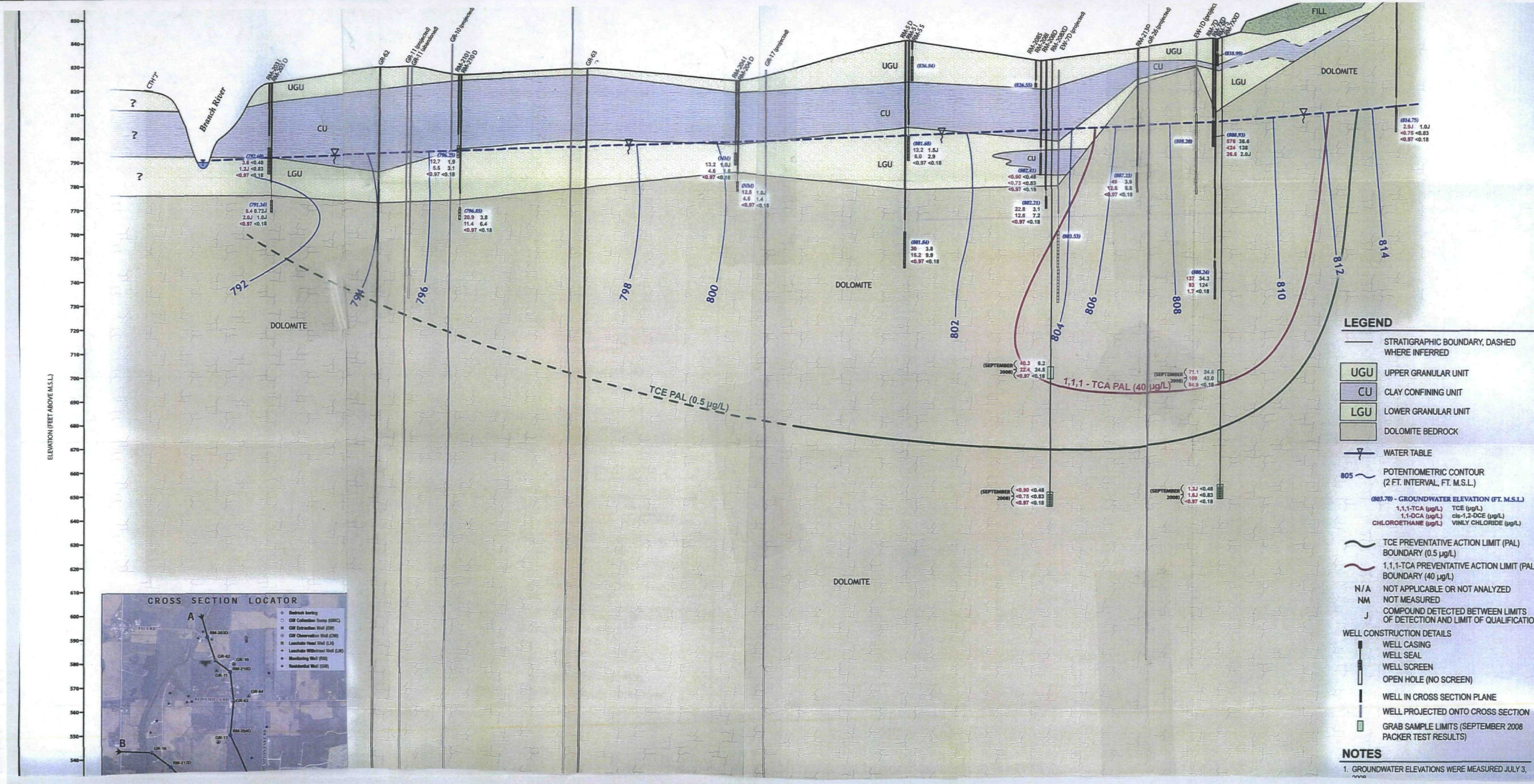
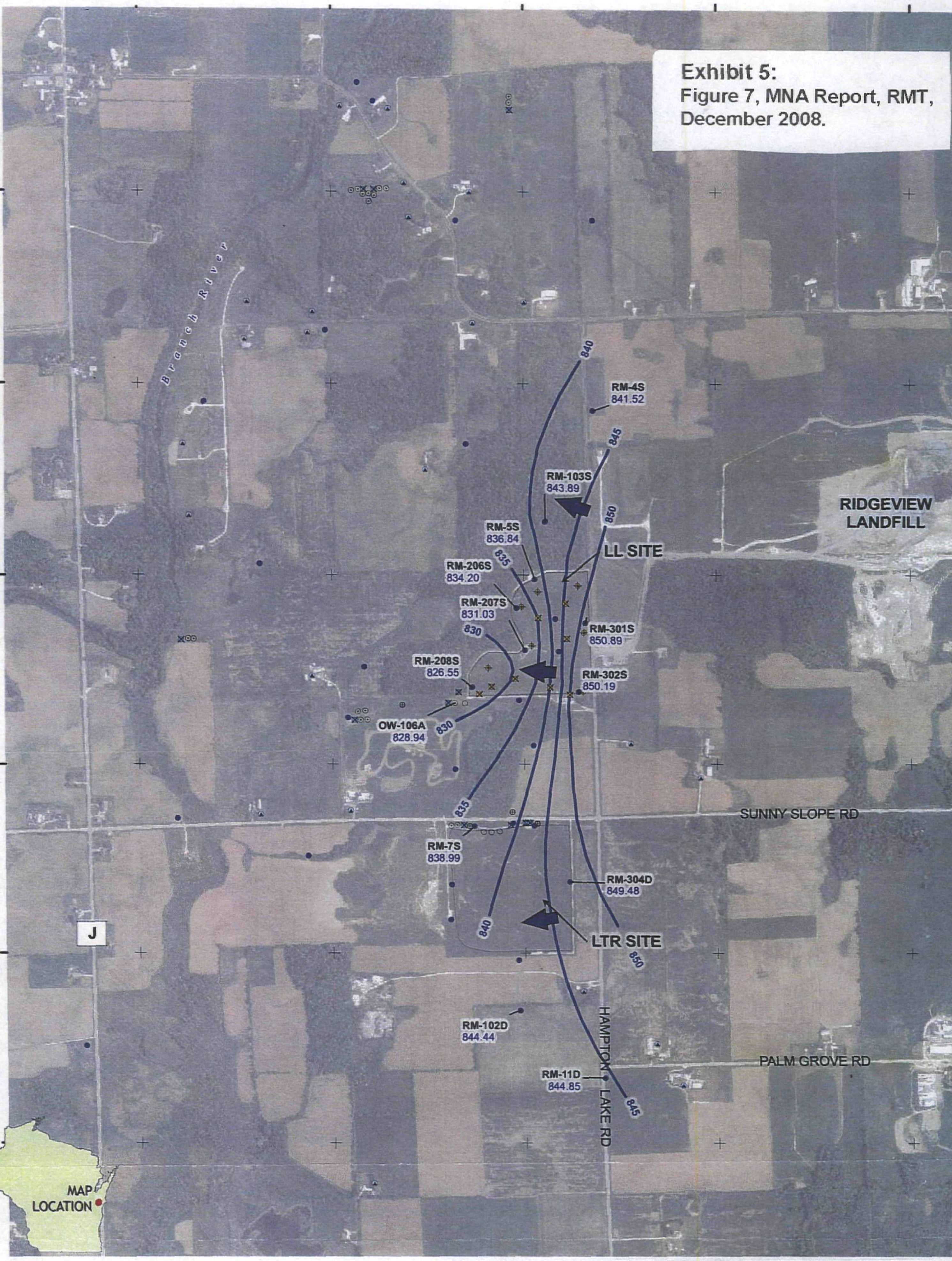


Exhibit 1, Appendix A, Summary of Groundwater Pump-and-Treat..., RMT, March 2009

Exhibit 5:
Figure 7, MNA Report, RMT, December 2008.



LEGEND

SAMPLE AND MONITORING LOCATIONS

- BEDROCK BORING
- GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- MONITORING WELL (RM)
- RESIDENTIAL WELL (GW)
- LANDFILL AREA

INFERRED GROUNDWATER FLOW DIRECTION

PERCHED WATER TABLE WELL LOCATION AND WATER TABLE ELEVATIONS (FT MSL)

RM-11D
(842.33)

Elevation Contour FT MSL.
5 FT Contour Interval
(Dashed Where Inferred)

840

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES ARE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. WATER ELEVATIONS MEASURED JULY 3, 2008.

0 1,000 FEET

1" = 1,000'
1:12,000

N

PROJECT: **LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**

SHEET TITLE: **PERCHED WATER TABLE JULY 2008**

DRAWN BY: BENTON K	SCALE: AS NOTED	PROJ. NO.	00-03457
CHECKED BY: THC		FILE NO.	34574603
APPROVED BY: JDW	DATE PRINTED: 12/22/2008	**FIGURE 7**	
DATE: DECEMBER 2008			

RMT

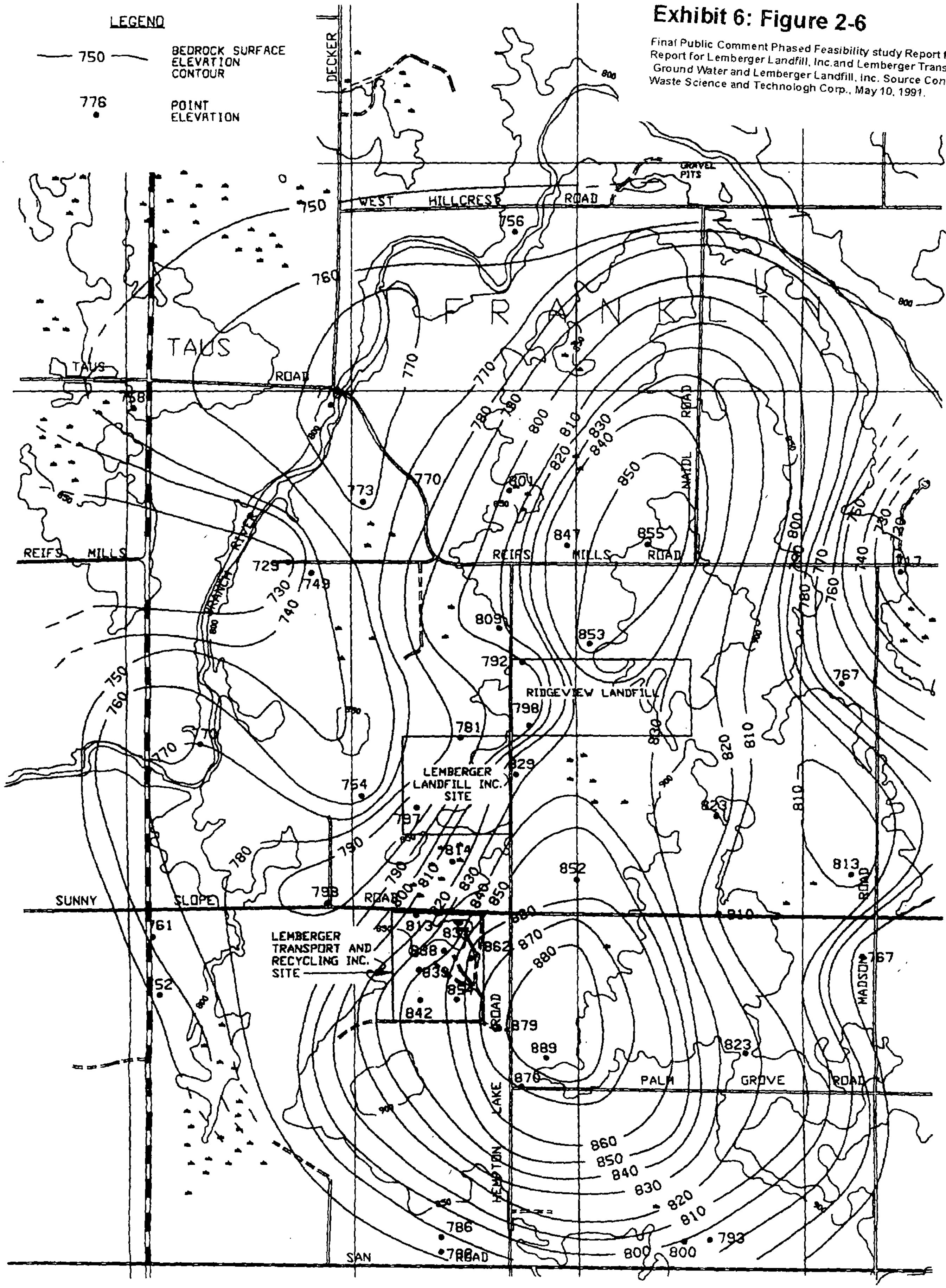
744 Heartland Trail
Madison, WI 53717-193
P.O. Box 8923 53708-89
Phone: 608-831-4444
Fax: 608-831-3334

D:\03457\46\mxd\34574603.mxd 12/22/2008 11:11:34

CAD DWG NO: C0000650
DATE: 12-07-90 AND
PLOT SCALE: 1=1

Exhibit 6: Figure 2-6

Final Public Comment Phased Feasibility study Report for Lemberger Landfill Report for Lemberger Landfill, Inc. and Lemberger Transport & Recycling, Inc. Ground Water and Lemberger Landfill, Inc. Source Control Operable Unit, B & Waste Science and Technologh Corp., May 10, 1991.



SOURCE:

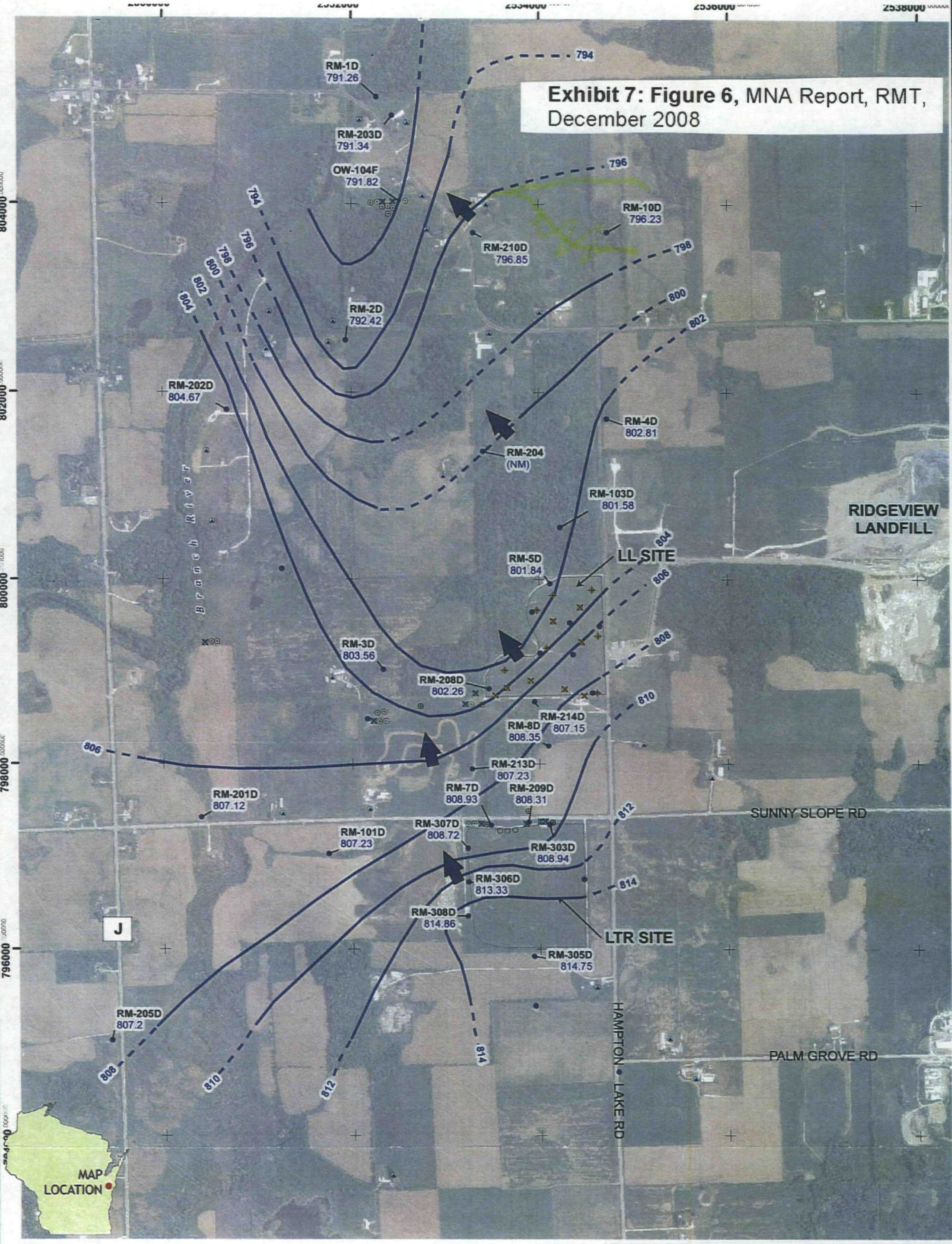
BASE MAP FROM USGS WHITELAW, WISCONSIN QUADRANGLE 7.5 MINUTE SERIES.

SCALE

1000' 0' 1000' 2000'

FIGURE 2-6
BEDROCK SURFACE CONTOUR MAP

Exhibit 7: Figure 6, MNA Report, RMT, December 2008



LEGEND

SAMPLE AND MONITORING LOCATIONS

- ⊕ BEDROCK BORING
- ○ GW COLLECTION SUMP (GWC)
- ✖ GW EXTRACTION WELL (EW)
- ⊙ GW OBSERVATION WELL (OW)
- ✕ LEACHATE HEAD WELL (LH)
- ✦ LEACHATE WITHDRAWL WELL (LW)
- ● MONITORING WELL (RM)
- ◉ RESIDENTIAL WELL (GW)
- ▭ LANDFILL AREA

INFERRED GROUNDWATER FLOW DIRECTION

BEDROCK WELL LOCATION AND GROUNDWATER ELEVATIONS (FT MSL)

RM-205D
(804.83)

Elevation Contour FT MSL.
2 FT Contour Interval
(Dashed Where Inferred)

808

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES ARE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. WATER ELEVATIONS MEASURED JULY 3, 2008.
4. THE MAPPED POTENTIOMETRIC SURFACE INCLUDES BEDROCK WATER TABLE OBSERVATION WELLS (SOUTH AND EAST) AND BEDROCK PIEZOMETERS (NORTH AND WEST).

N

0 1,000 FEET 1:12,000 1" = 1,000'

PROJECT: LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN

SHEET TITLE: BEDROCK POTENTIOMETRIC SURFACE JULY 2008

DRAWN BY: BENTON K	SCALE:	PROJ. NO.	00-03457.
CHECKED BY: THC	AS NOTED	FILE NO.	34574604.n
APPROVED BY: JDW	DATE PRINTED:	FIGURE 6	
DATE: DECEMBER 2008	12/22/2008		

RMT

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Exhibit 8: Table 1-14, RI.

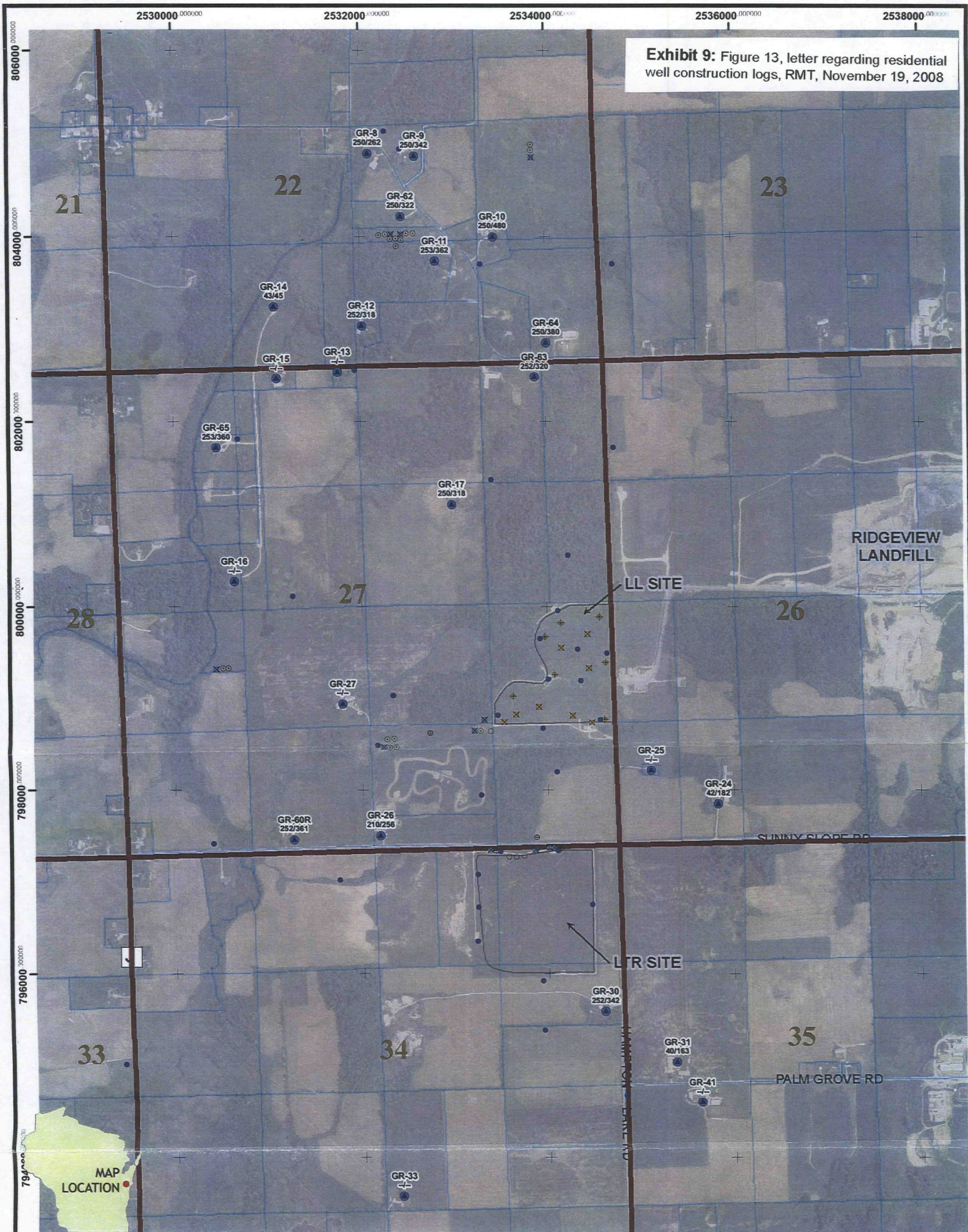
TABLE 1-14
VOLATILE ORGANICS DETECTED IN RESIDENTIAL WELL SAMPLES
FRANKLIN TOWNSHIP, WI
PERFORMED BY WDNR, 1984, 1985, 1986
LEMBERGER SITES REMEDIAL INVESTIGATION REPORT, BVWST 1990

VOLATILE ORGANIC COMPOUND (ug/L) (VOC)	Detection Limit (ug/L)	RESIDENT NAME, WELL NUMBER, AND SAMPLING DATE															
		Hanely GR-8				Sauer GR-9				Wellner GR-10				Kalies GR-11			
		1/28/85	3/12/85	10/7/85	3/12/86	1/28/85	3/12/85	10/7/85	1/28/86	12/18/84	1/28/85	10/7/85	4/20/87	2/12/85	3/19/85	10/7/85	2/11/86
1,1-Dichloroethylene	1.0	ND	ND	ND	ND	ND	1.9	ND	ND	5.9	6.9	5.4	4.4	1.1	ND	ND	ND
1,1-Dichloroethane	1.0	ND	ND	ND	ND	2.0	1.6	ND	ND	1.9	1.7	1.5	1.4	ND	ND	ND	ND
1,2-Dichloroethane	1.0	ND	ND	ND	ND	3.2	ND	ND	ND	11	13	9.5	6.3	2.8	2.2	ND	1.8
1,1,1-Trichloroethane	1.0	7.7	6.8	5.6	4.0	8.7	7.9	ND	3.4	27	29	29	26	8.5	6.3	ND	5.8
Trichloroethylene	1.0	ND	ND	ND	ND	1.7	1.3	ND	ND	6.3	6.6	4.8	4.3	1.9	1.4	ND	2.6
TOTAL VOCs		7.7	6.8	5.6	4.0	15.6	12.7	0.0	3.4	52.1	57.2	50.2	42.4	14.3	9.9	0.0	10.2

VOLATILE ORGANIC COMPOUND (ug/L) (VOC)	Detection Limit (ug/L)	RESIDENT NAME, WELL NUMBER, AND SAMPLING DATE												
		Dugan GR-12					Menza GR-17				Lemberger GR-30			
		1/28/85	2/25/85	10/7/85	10/7/85*	4/20/87*	1/28/85	2/25/85	10/7/85	4/20/87*	3/5/85	3/19/85	10/7/85	3/12/86
Chloroform	1.0	ND	ND	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	1.0	12	10	8.8	ND	ND	24	27	25	ND	1.6	1.5	26	6.5
1,1-Dichloroethane	1.0	2.7	2.7	2.0	ND	ND	2.4	3.6	5.2	ND	1.9	1.6	2.8	1.9
1,2-Dichloroethane	1.0	23	24	15	ND	ND	29	29	26	ND	2.4	2.8	7.6	2.6
1,1,1-Trichloroethane	1.0	49	56.0	34	ND	ND	48	54.0	44	ND	42	41	43	41
Trichloroethylene	1.0	15	12	7.5	ND	ND	12	11.0	10	ND	33	33	20	24
TOTAL VOCs		101.7	104.7	69.3	0.0	0.0	115.4	124.6	110.2	0.0	80.9	79.9	99.4	76.0

NOTES:

1. * - Represents replacement well installed in proximity to original well, which was taken out of service.
2. ND - Not detected
3. Samples collected by WDNR and analyzed by Wisconsin State Laboratory of Hygiene.
4. Only wells (7 of 43) showing detection of volatile organic compounds are listed.



LEGEND

SAMPLE AND MONITORING LOCATIONS

- ⊕ BEDROCK BORING
- ○ GW COLLECTION SUMP (GWC)
- ✖ GW EXTRACTION WELL (EW)
- ⊙ GW OBSERVATION WELL (OW)
- ✖ LEACHATE HEAD WELL (LH)
- ✦ LEACHATE WITHDRAWL WELL (LW)
- ● MONITORING WELL (RM)

RM-203D SENTINEL WELLS

RM-303D NEAR FIELD WELLS DESIGNATED FOR QUARTERLY SAMPLING

LANDFILL AREA

210/256 ● RESIDENTIAL WELL (GW) SHOWING **CASING DEPTH / TOTAL DEPTH** (FEET) WHERE KNOWN

0 1,000 FEET

1" = 1,000'

1:12,000

N

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. ADDITIONAL WELL CONSTRUCTOR'S REPORTS FOR WELLS THAT COULD NOT BE MATCHED TO A NAME/ADDRESS/LOCATION ARE CONTAINED IN ATTACHEMNT 1.

PROJECT: **LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**

SHEET TITLE: **RESIDENTIAL WELL LOCATIONS AND CASING DEPTHS**

DRAWN BY: HANKLEY C	SCALE:	PROJ. NO. 00-03456.46	
CHECKED BY: LJB	AS NOTED	FILE NO. 34564307.mxd	
APPROVED BY: JEW	DATE PRINTED: 11/19/2008	**FIGURE 13**	
DATE: NOVEMBER 2008			

RMT

744 Heartland Trail
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Phone: 608-831-4444
Fax: 608-831-3334

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TABLE 1-2
SUMMARY OF WASTE TYPES, GENERATORS, AND VOLUMES (RMT, 1981)
LEMBERGER TRANSPORT AND RECYCLING, INC. SITE

WASTE TYPE	VOLUME (Gallons)	PERCENT OF TOTAL
Wood Tar Distillates	476,984	55.1%
Oil-Water Mixtures	18,800 18,800 7,300 2,860 -------- *47,760	5.5%
Paint Wastes	13,815 2,080 -------- 15,895	1.8%
Acids	6,750	0.8%
Solvents	8	0.001%
Aluminum Dust	**305,360	35.3%
Dyes	18	0.002%
Weed Killer	20	0.002%
Organic Chemicals	3	--
Inorganic Chemicals	9	0.001%
Ether	3	--
Coating Wastes	400	0.05%
Alcohol	100	0.01%
Phosphorous	155	0.018%
Oil Sludge	700	0.08%
Silt, Sand, Gas, Sludge	4,700	0.54%
Industrial Sludge (Oil Base)	6,100	0.71%
TOTAL:	864,965	100.0%

NOTES:
1. * Consists of approximately 15,000 gallons of oil and 32,760 gallons of water.
2. ** Estimate based on 1,512 cubic yards at 201 gallons per cubic yard.

SOURCE: Final Remedial Investigation Report, January 18, 1991

Exhibit 11: Table 5, Record of Decision, EPA, September 23, 1991.

Table 5

GROUND WATER CLEANUP STANDARDS

Contaminants of Concern	Risk-Based Cleanup Goals	USEPA Max. Contaminant Level (a)	USEPA Max. Contaminant Level Goal (a)	Wisconsin Enforcement Standard (b)	Wisconsin Preventive Action Limit (b)	Maximum Conc. Detected in Groundwater
	Cleanup Standards					
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Methylene Chloride	5	5 (c)	0 (c)	150	15	5,000
Acetone	1,000	--	--	--	--	14,000
1,1-Dichloroethene	0.06	7	7	7	0.024	200
1,1-Dichloroethane	0.4	--	--	850	85	2,200
1,2-Dichloroethene	200	70 (c)	--	100	10	4,000
2-Butanone	500	--	--	--	--	21,000
1,1,1-Trichloroethane	900	200	200	200	40	3,200
Trichloroethene	3	5	0	5	0.18	510
4-Methyl-2-pentanone	100	--	--	--	--	2,400
Tetrachloroethene	0.7	5 (c)	0 (c)	1	0.1	200
Toluene	3,000	2,000 (c)	2,000 (c)	343	68.6	400
Xylene	1,000	10,000 (c)	10,000 (c)	620	124	480
Bis(2-ethylhexyl)phthalate	2	--	--	--	--	160
Heptachlor	0.008	0.4 (c)	0 (c)	--	--	0.1
Aldrin	0.002	--	--	--	--	0.46
Dieldrin	0.002	--	--	--	--	0.006
4,4-DDT	0.1	--	--	--	--	0.18
Arochlor-1248	0.005	0.5 (c)	0 (c)	--	--	2.7
Arochlor-1254	0.005	0.5 (c)	0 (c)	--	--	2.5
Barium	0.9	1,000	--	1,000	200	1,580
Cadmium	0.01	10	5 (c)	10	1	14.9
Chromium	0.002	50	--	50	5	53.6
Lead	6	50	0 (c)	50	5	8.9
Zinc	2,000	--	--	5,000(d)	2,500(d)	500
Arsenic	0.001	50	0 (c)	50	5	10.9
Beryllium	0.01	1	0 (c)	--	--	2
Manganese	2	--	--	0.05(d)	0.025(d)	3,280
Mercury	3	2	2 (c)	2	0.2	1.9
Selenium	30	10	50 (c)	10	1	3.5
Silver	30	50	--	50	10	69.7
Chloroform	1.1	100	--	6	0.6	24
Carbon Tetrachloride	0.3	5	0	5	0.5	82
Vinyl Chloride	0.017	2	0	0.2	0.0015	28

(a) Code of Federal Regulations, Chapter 40, Part 241.

(b) Chapter NR 140, Wisconsin Adminisstrative Code

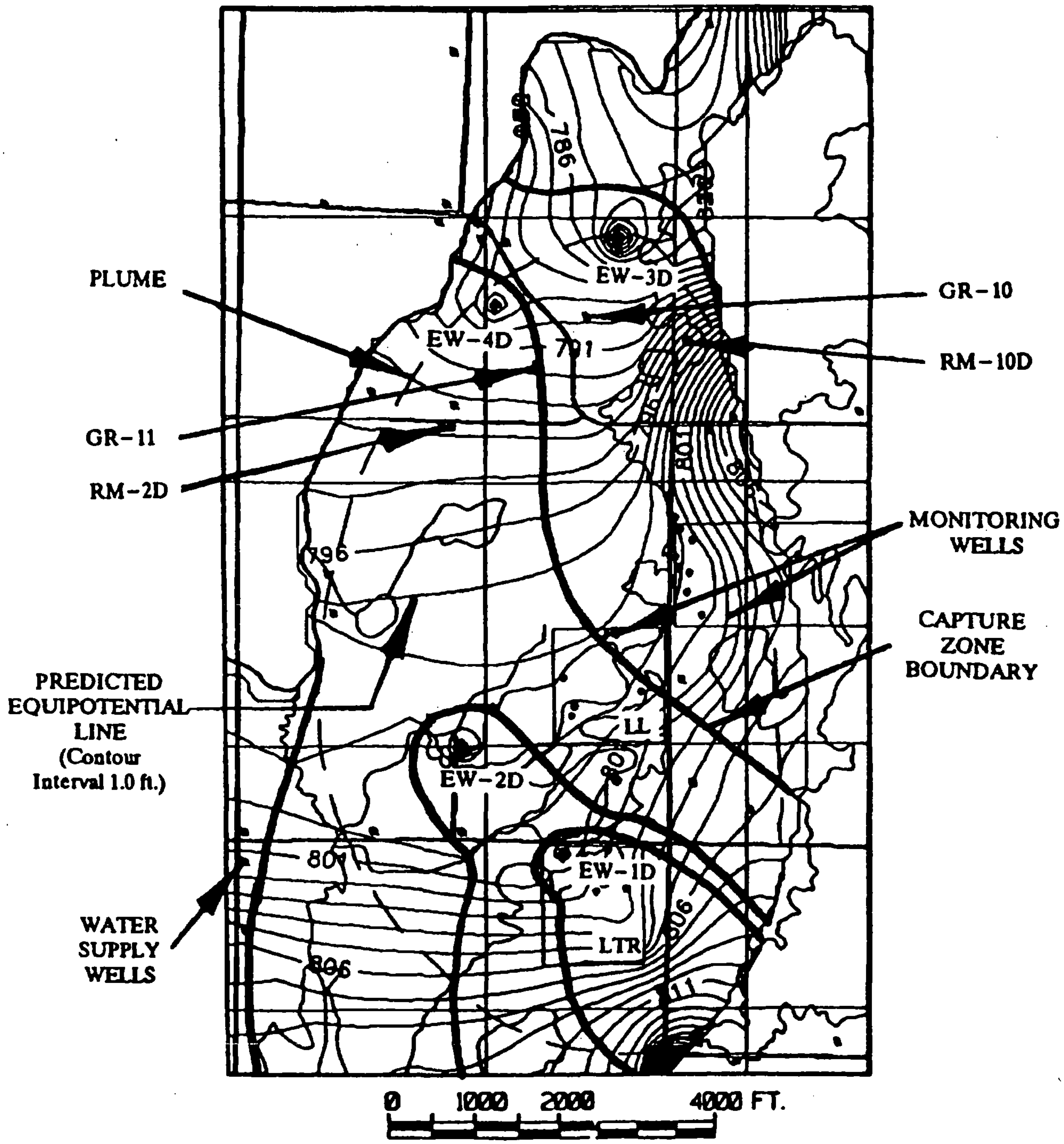
(c) Proposed Standard.

(d) These standards are based only on public welfare, not public health.

-- indicates that no standard is provided.

[shaded box] indicates cleanup standard for use for Lemberger sites remedial action

Exhibit 12: Figure 4-2, Final Design Report Lemberger Landfill RD/RA Operable Unit, Malcomb Pirnie, January 10, 1995

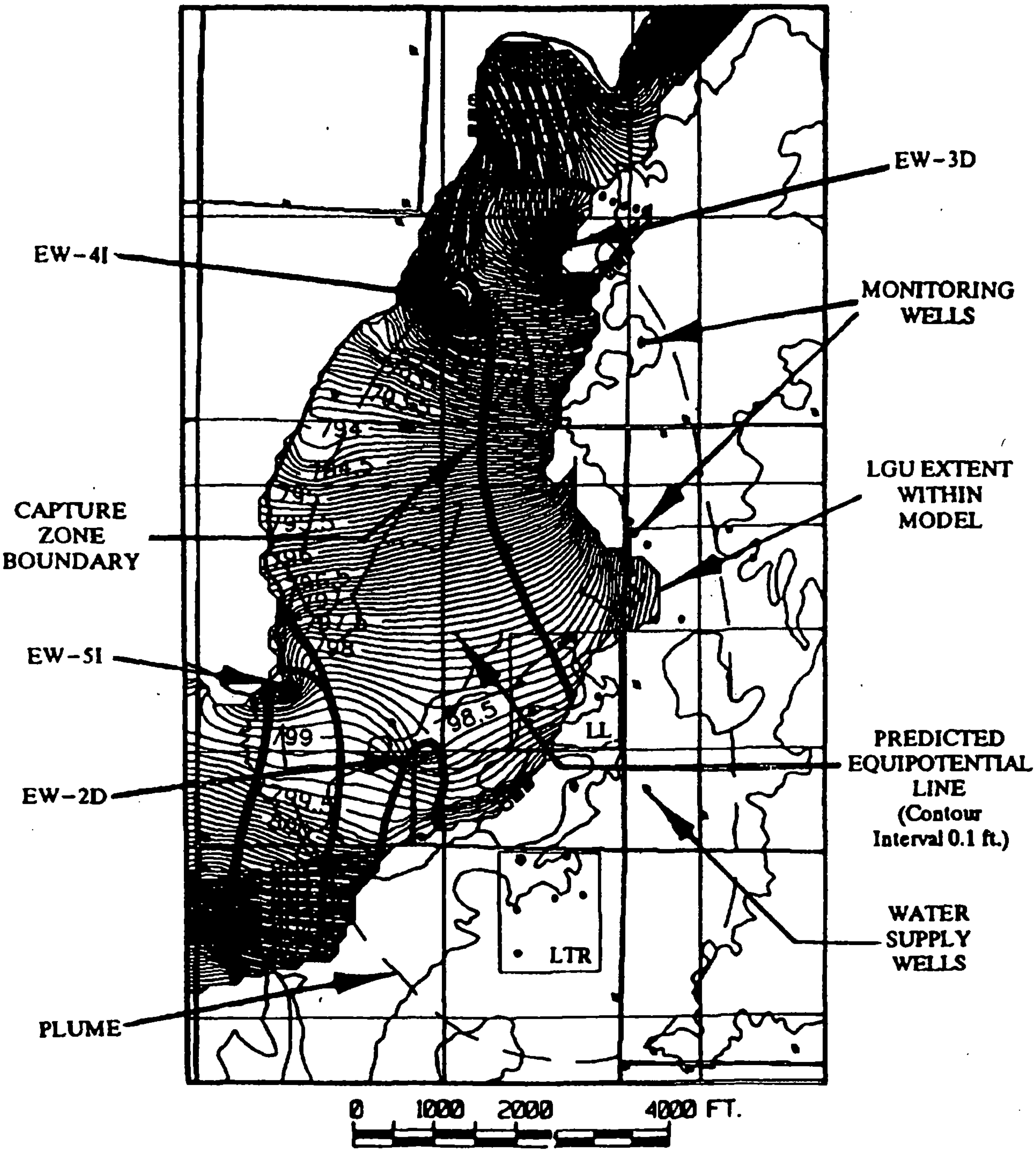


MALCOLM PIRNIE

CAPTURE ZONES IN THE BEDROCK
LEMBERGER LANDFILL RD\RA ACTIVITIES

FIGURE 4-2

Exhibit 13: Figure 4-3, Final Design Report Lemberger Landfill.



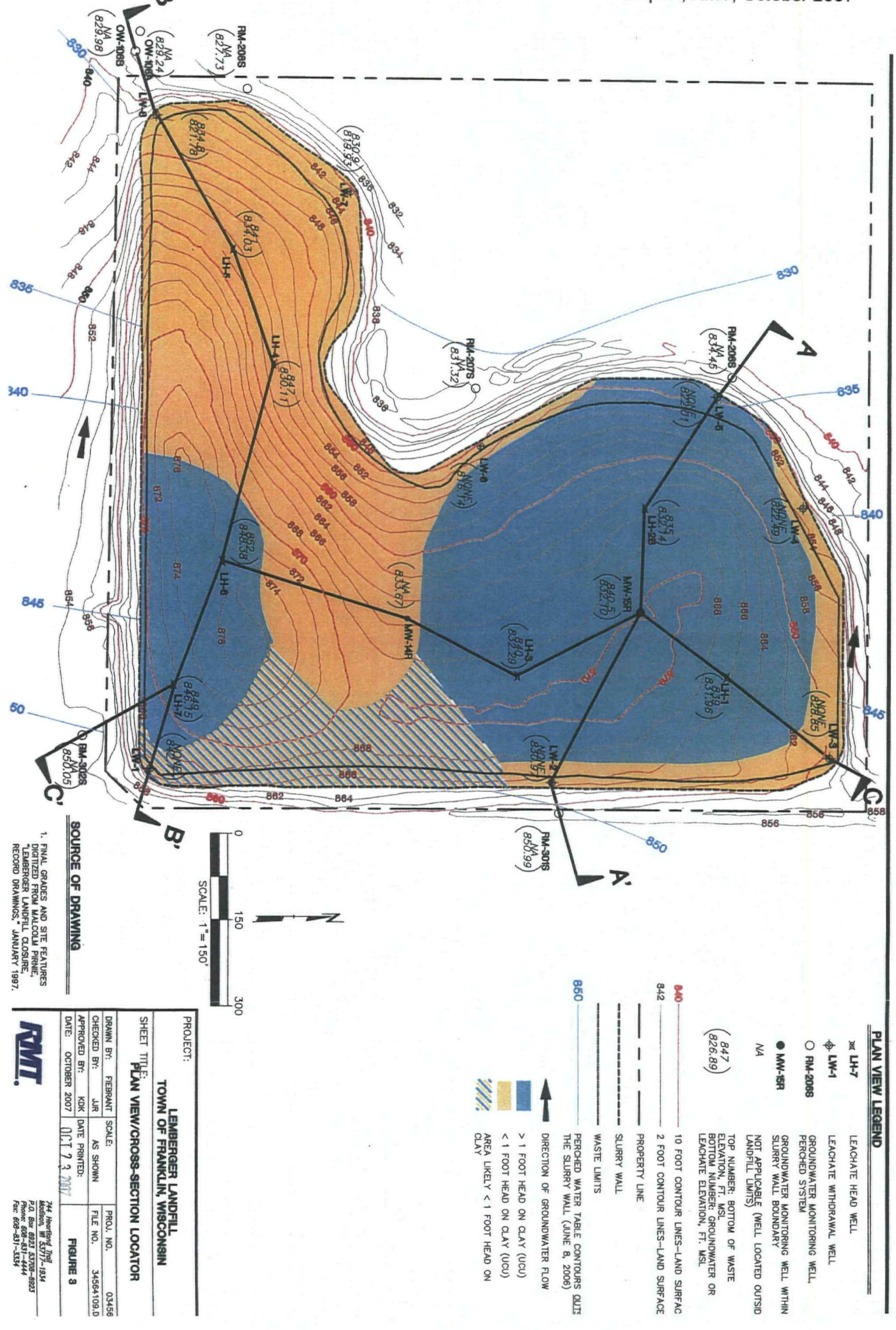
MALCOLM PIRNIE	**CAPTURE ZONES IN THE LGU** LEMBERGER LANDFILL RD\RA ACTIVITIES	FIGURE 4-3

Exhibit 14: Figure 4-1, Final Design Report Lemberger Landfill.

TABLE 4-1 EXTRACTION WELL FLOW RATES AND DRAWDOWNS		
Well	**Flow Rate (gpm)**	**Drawdown (ft)**
EW-1D	25	1
EW-2D	50	3
EW-3D	50	36
EW-4I	50	19
EW-4D	10	15
EW-5I	25	4
EW-6S	3	4

PLOT DATA
Drawing Name: J:\03456\41\34564109.dwg
Operator Name: fiebrant
Scale: 1"=1500'

Exhibit 15: Figure 3, Leachate Head Evaluation Report, RMT, October 2007



per Month Since Startup

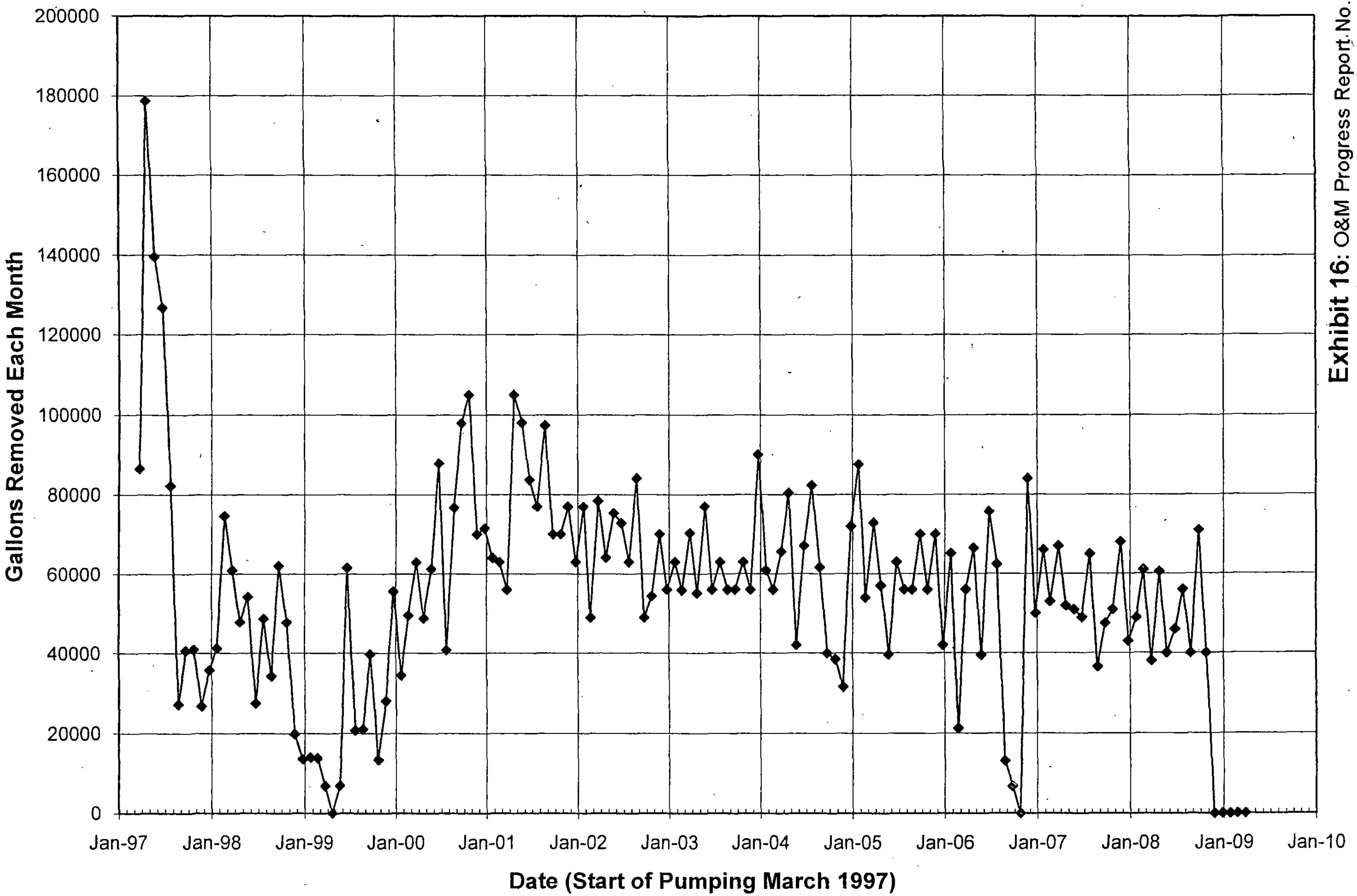


Exhibit 16: O&M Progress Report No. 19, July 2008 - June 2009 Reporting Period, RMT, Janua 2010

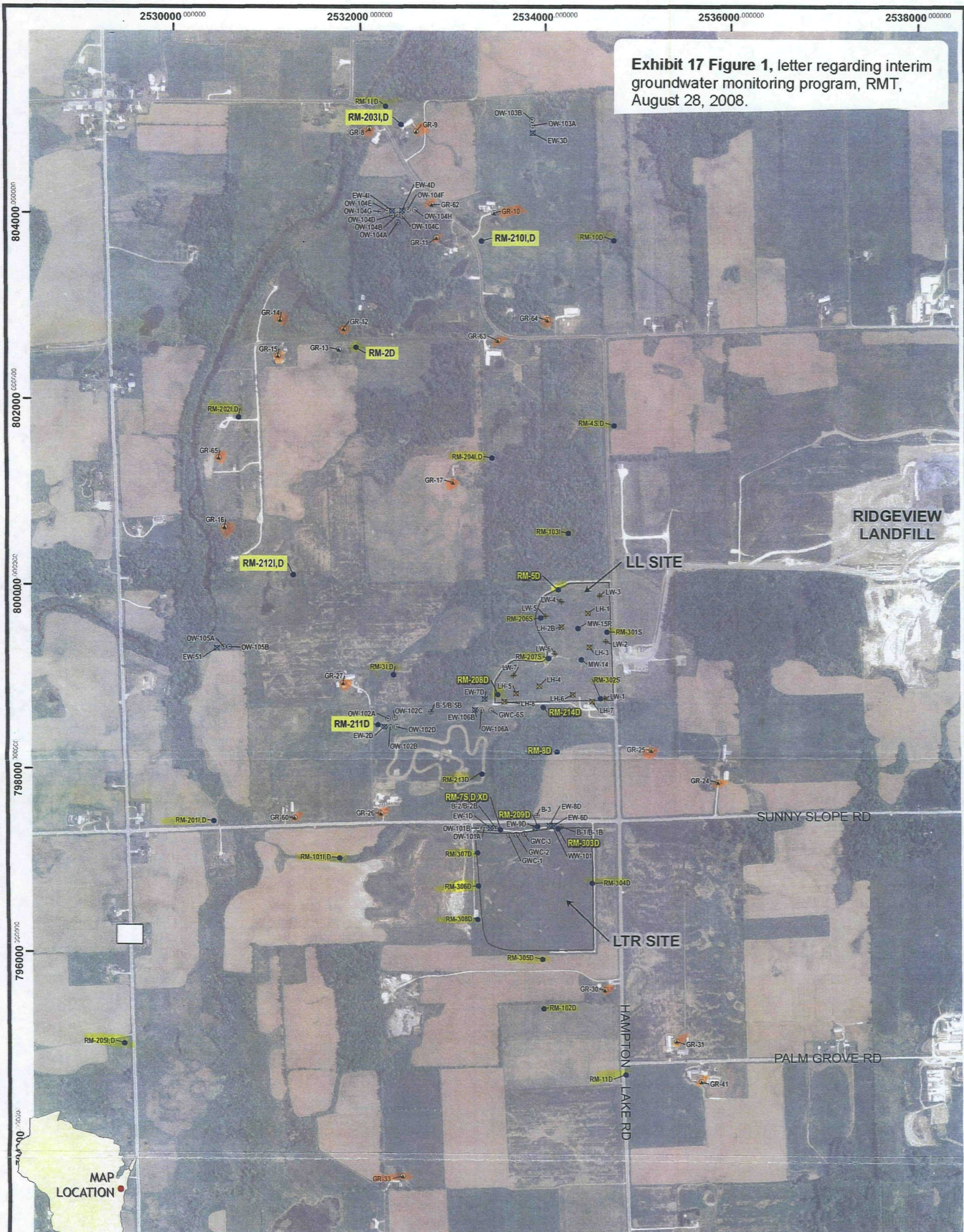
Figure 1

Prepared by RMT 1/6/2010

I:\WPMSN\PJT\00-03459\11\000345911-001.xlsm 1/6/2010

APPENDIX A

Exhibit 17 Figure 1, letter regarding interim groundwater monitoring program, RMT, August 28, 2008.



LEGEND

SAMPLE AND MONITORING LOCATIONS

- BEDROCK BORING
- GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- MONITORING WELL (RM)
- RESIDENTIAL WELL (GW)

LANDFILL AREA

RM-203D SENTINEL WELLS

RM-303D NEAR FIELD WELLS DESIGNATED FOR QUARTERLY SAMPLING

residential wells

monitoring wells sampled annually (exclude RM-1 ...)

NOTES

1. AERIAL IMAGERY FROM USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.

0 1,000 FEET

1 " EQUALS 1,000 '

1:12,000

N

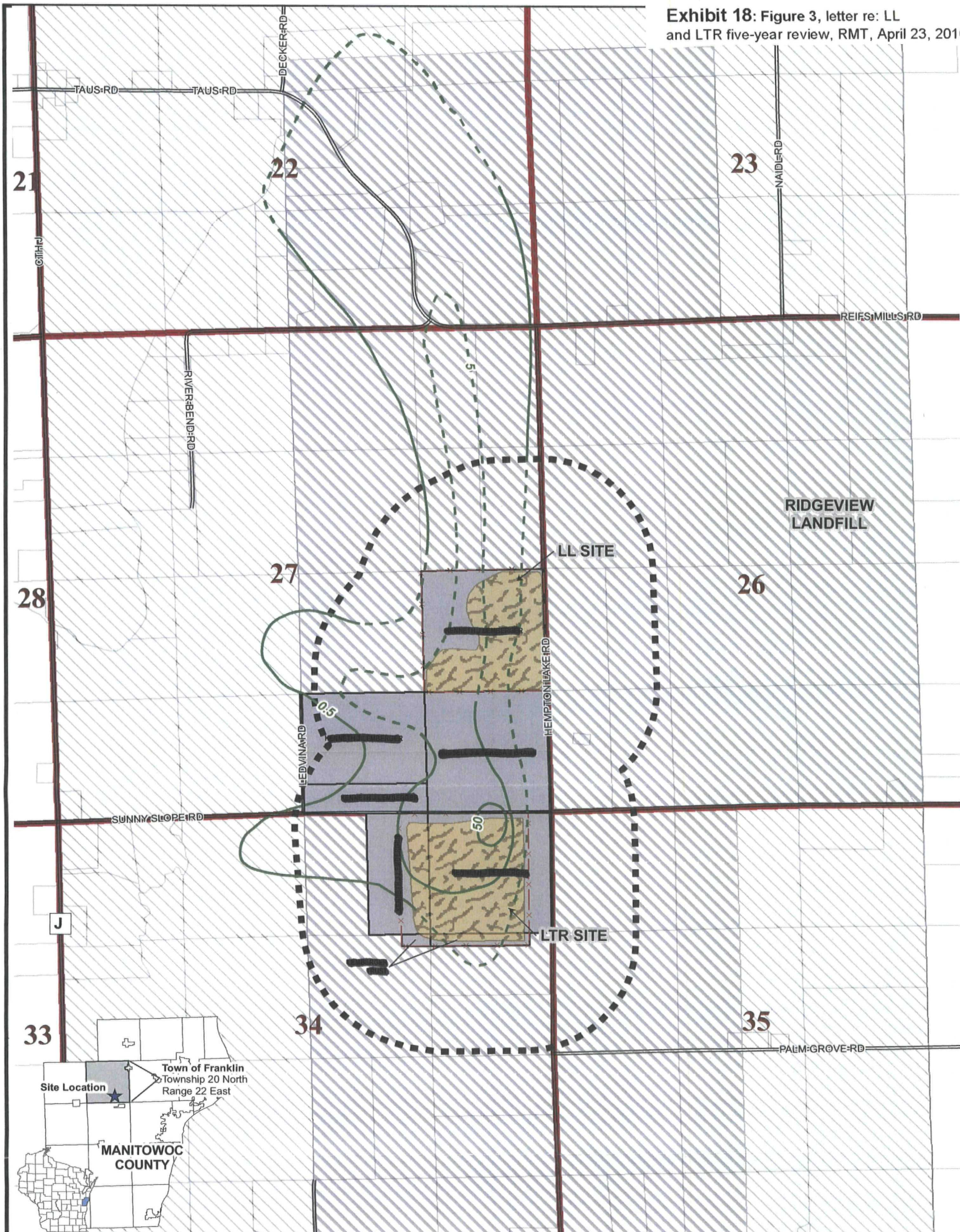
PROJECT: LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN			
SHEET TITLE: SITE PLAN SHOWING ALL MONITORING POINTS			
DRAWN BY: HANKLEY C.	SCALE:	PROJ. NO.	00-03457.45
CHECKED BY: CLAUSEN T	AS NOTED	FILE NO.	34574501.mxd
APPROVED BY: KRAUSE K	DATE PRINTED: 8/28/2008	FIGURE 1	
DATE: AUGUST 2008			

RMT

744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

D:\03457\45\mxd\34574501.mxd 8/28/2008 12:58:14

Exhibit 18: Figure 3, letter re: LL and LTR five-year review, RMT, April 23, 2010



LEGEND

- ROADS
- TCE CONTOUR (DASHED WHERE INFERRED)
- FENCE AROUND LANDFILL AREA
- NR 812.10(2) BOUNDARY - 1200' SETBACK
- NR 506.085 - LIMITS OF WASTE
- NR 812.09 - WDNR WELL PREAPPROVAL REQUIRED
- NR 812.09 - 250' CASING REQUIRED
- PARCELS WITH USE RESTRICTION AGREEMENTS

0 1,000 2,000 FEET

1" = 1,000'
1:12,000

N

PROJECT:	LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN		
SHEET TITLE:	STATE RESTRICTIONS AND DEED RESTRICTED AREAS WITH TCE PLUME		
DRAWN BY: PAPEZ J	SCALE:	PROJ. NO.	00-03458.40
CHECKED BY: RICE J	AS NOTED	FILE NO.	34584025_5.mxd
APPROVED BY: KRAUSE K	DATE PRINTED: APR 23 2010	FIGURE 3	
DATE: APRIL 2010			

RMT

744 Heartland Trail
Madison, WI 53717-1934

P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

D:\03458\40\mxd\34584025_5.mxd 4/19/2010 14:41:50

VOL 2468 PG 2[illegible]

Document Number

DOC# 1065459

ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANTS

STATE OF WI - MTWC C[illegible]
PRESTON JONES REG/DE[illegible]
RECEIVED FOR RECOR[illegible]
05/28/2009 9:35:42 AM

Drafted by and after recording return to:
Attorney Douglas B. Clark
Foley & Lardner LLP
P. O. Box 1497
Madison, WI 53701-1497

005-027-013-000.00,
Part of 005-034-002-001.00 and
Part of 005-034-001-000.00
Parcel Identification Number(s)

25clk

This Environmental Protection Easement and Declaration of Restrictive Covenants (the "Agreement") is made this 20th day of May 2009, by and between Kenneth J. Lemberger, an unmarried man (the "Grantor"), and the Lemberger Sites Remediation Group ("LSRG") ("the Grantee"). The Grantor and Grantee intend that the provisions of this Agreement also be for the benefit of the Wisconsin Department of Natural Resources ("WDNR") and the United States. WDNR and the United States are hereinafter referred to as the "Third Party Beneficiaries."

WITNESSETH:

WHEREAS, Grantor is the owner of certain land in Manitowoc County, Wisconsin, more particularly described on Exhibit A attached hereto and made a part hereof (the "Property");

WHEREAS, the LSRG is comprised of the City of Manitowoc, Manitowoc Company, Manitowoc Public Utilities, Newell Company and Red Arrow Products Company, LLC;

WHEREAS, the WDNR is acquiring this interest pursuant to Wisconsin Statutes Sec. 292.31;

WHEREAS, the Property includes the Lemberger Landfill ("LL") and part of the Lemberger Transport Recycling ("LTR") Superfund sites located near the Village of Whitelaw, which have been listed on the National Priority List under the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA");

WHEREAS, the Owner and the LSRG previously executed a Global Access Agreement dated May 31, 1995 and an Amended and Restated Global Access and Easement Agreement dated June 23, 2000 (the "Prior Agreements"), which Prior Agreements specified the conditions upon which the LSRG was granted unrestricted, continuous and permanent access to the Property for itself, for the United States Environmental Protection Agency ("U.S. EPA"), for the WDNR, and each of their contractors, consultants and representatives;

WHEREAS, pursuant to the Prior Agreements, the LSRG has been investigating and remediating hazardous substance contamination and restoring the LL and the LTR sites (the

"Remediation") under the direction of the U.S. EPA and the WDNR, pursuant to Consent Decree No. 92-C-0583 (E.D. Wis. 1992) (the "Consent Decree") and the Administrative Order by Consent No. V-W-93-C-196 (U.S. EPA Region V, 1993) (the "AOC");

WHEREAS, the parties wish to reaffirm the Prior Agreements in their entirety and to clarify and agree to the following: (1) to grant a permanent right of access over the Property to the Grantee for purposes of implementing, facilitating and monitoring the remedial action; and (2) to impose on the Property use restrictions as covenants that will run with the land for the purpose of protecting human health and the environment; and

WHEREAS, Grantor wishes to cooperate with the Grantee in the implementation of all response actions at the Site.

NOW, THEREFORE:

1. <u>Grant</u>: Grantor, on behalf of itself, its successors and assigns, and in consideration of the terms of the Consent Decree and the AOC, does hereby covenant and declare that the Property shall be subject to the restrictions set forth herein. Furthermore, Grantor on behalf of itself, its successors and assigns, and in consideration of the terms of the Consent Decree and the AOC does give, grant and convey to the Grantee and its assigns, (1) the perpetual right to enforce said use restrictions, and (2) an environmental protection easement of the nature and character, and for the purposes explained in this Agreement, with respect to the Property.

2. <u>Purpose:</u> It is the purpose of this Agreement to convey to the Grantee rights to facilitate the remediation of past environmental contamination and to protect human health and the environment by reducing the risk of exposure to contaminants. It is also the purpose of this Agreement that the Third Party Beneficiaries shall have the right to enforce the terms of this Agreement.

3. <u>Third Party Beneficiaries:</u> Grantor and Grantee, on behalf of themselves and their successors, transferees, and assigns, hereby agree that the WDNR and the United States, together with their successors and assigns, are the intended third party beneficiaries of all the benefits and rights conveyed to the Grantee under this Agreement.

4. <u>Restrictions on use:</u> The following covenants, conditions, and restrictions apply to the use of the Property for the benefit of the Grantee and the Third Party Beneficiaries and are binding upon the Grantor including its successors, transferees, assigns or other person acquiring an interest in the Property and their authorized agents, employees, or persons acting under their direction and control.

(a) Groundwater underlying the Property shall not be extracted, consumed, exposed or utilized in any way, except for the limited purpose of treating and monitoring groundwater contamination levels in accordance with plans approved by the U.S. EPA.

(b) There shall be no disturbance of the surface or subsurface of the land in any manner, including but not limited to filling, drilling, excavation, removal of topsoil, rock or minerals, or change of the topography in any manner.

5. Modification of restrictions: Any request for modification or rescission of this Agreement shall be made to the Grantee, the WDNR and the U.S. EPA at the addresses given below. This Agreement may be modified or rescinded only with the written approval of the U.S. EPA Superfund Division Director and the Director of the WDNR. Grantor, on behalf of its successors, transferees, assigns or other person acquiring an interest in the Property, agrees to file any U.S. EPA approved and WDNR approved modification to or rescission of the Agreement with the appropriate Registrar of Deeds and a certified copy shall be returned to the U.S. EPA and the WDNR at the addresses listed below.

6. Environmental Protection Easement: Grantor hereby conveys and grants to the LSRG, to the Grantee, to the Third Party Beneficiaries and to their contractors, consultants and representatives, an irrevocable, permanent and continuing environmental protection easement for access to and use of, at all reasonable times, the Property for purposes of: (i) preparing for and conducting the Remediation, including but not limited to the construction, operation and maintenance of a groundwater treatment system, a portion of which may be located on the Property and (ii) any other purpose deemed reasonably necessary by the LSRG, U.S. EPA, and/or WDNR, pursuant to the Consent Decree, the AOC, and the Prior Agreements. Subparagraph (ii) shall not be interpreted to expand the purposes for which this easement is given, but shall be interpreted to be consistent with subparagraph (i) and the purpose for which this easement is needed.

7. No Ownership. This Agreement shall not be interpreted as conveying to the LSRG, or any other party, any ownership rights to the Property. This Agreement shall not be interpreted as changing any of the provisions of the Prior Agreements. Grantor acknowledges that it has already agreed to refrain from activity on the Property, or on any additional Grantor-owned property in the vicinity of the Property, that could negatively affect the LSRG's remediation efforts or exacerbate the soil or groundwater contamination at or in the vicinity of the LL or LTR sites.

8. Reservation of Legal Rights. Nothing in this Agreement shall limit or otherwise affect U.S. EPA's rights of entry and access or U.S. EPA's authority to take response actions under CERCLA, the NCP, or other federal law, statute, rule or administrative order.

9. No Public Access and Use: No right of access or use by the general public to any portion of the Property is conveyed by this Agreement.

10. Notice requirement: Grantor agrees to include in any instrument conveying any interest in any portion of the Property, including but not limited to deeds, leases, easements, licenses and mortgages, a notice which is in substantially the following form:

NOTICE: THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE

COVENANTS IN FAVOR OF, AND ENFORCEABLE BY THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES AND THE UNITED STATES OF AMERICA AS THIRD PARTY BENEFICIARIES.

Within thirty (30) days of the date any such instrument of conveyance is executed, Grantor must provide Grantee with a certified copy of said instrument and, if it has been recorded in the public land records, its recording reference.

11. Administrative jurisdiction: The federal agency having administrative jurisdiction over the interests acquired by the United States by this Agreement is the U.S. EPA. The WDNR has administrative jurisdiction over the interests acquired by this Agreement.

12. Enforcement: Grantee and Third Party Beneficiaries shall be entitled to enforce the terms of this Agreement by resort to specific performance or legal process. All remedies available hereunder shall be in addition to any and all other remedies at law or in equity, including CERCLA. Enforcement of the terms of this Agreement shall be at the discretion of the Grantee, and any forbearance, delay or omission to exercise its rights under this Agreement in the event of a breach of any term of this Agreement shall not be deemed to be a waiver by the Grantee of such term or of any subsequent breach of the same or any other term, or of any of the rights of the Grantee under this Agreement.

13. Covenants: Grantor hereby covenants to and with the Grantee and the Third Party Beneficiaries, that the Grantor is the lawful fee simple owner of the Property.

14. Notices: Any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other shall be in writing and shall either be served personally or sent by first class mail, postage prepaid, addressed as follows:

To Grantor:

Kenneth Lemberger
10007 Reif Mills Road
Whitelaw, WI 54247

To Third Party Beneficiary:

Wisconsin Dept. of Natural Resources
101 South Webster Street
Madison, WI 53703

To Third Party Beneficiary:

U.S. Environmental Protection Agency
Region Five Administrator
77 West Jackson Boulevard
Chicago, IL 60604

To LSRG:

Douglas B. Clark
Foley & Lardner LLP
150 East Gilman Street
Madison, WI 53703
(608) 258-4276

15. General provisions:

(a) Controlling law: The interpretation and performance of this Agreement shall be governed by the laws of the United States or, if there are no applicable federal laws, by the law of the State of Wisconsin.

(b) Liberal construction: Any general rule of construction to the contrary notwithstanding, this Agreement shall be liberally construed in favor of the grant to effect the purpose of this Agreement and the policy and purpose of CERCLA. If any provision of this Agreement is found to be ambiguous, an interpretation consistent with the purpose of this Agreement that would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability: If any provision of this Agreement, or the application of it to any person or circumstance, is found to be invalid, the remainder of the provisions of this instrument, or the application of such provisions to persons or circumstances other than those to which it is found to be invalid, as the case may be, shall not be affected thereby.

(d) Entire Agreement: This Agreement sets forth the entire agreement of the parties with respect to rights and restrictions created hereby, and supersedes all prior discussions, negotiations, understandings, or agreements relating thereto, all of which are merged herein, except that unless expressly modified or amended herein, nothing in this Agreement is intended or shall be deemed to supersede, replace or amend the Prior Agreements, which remain in full effect and are legally binding on both parties.

(e) No Forfeiture: Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

(f) Termination of Rights and Obligations: A party's rights and obligations under this Agreement terminate upon transfer of the party's interest in the Easement or Property, except that liability for acts or omissions occurring prior to transfer shall survive transfer.

(g) Counterparts: The parties may execute this Agreement in two or more counterparts, which shall, in the aggregate, be signed by both parties; each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling.

(h) Binding Effect: All of the terms and conditions in this Agreement, including the benefits and burdens, shall run with the land as to the Property and shall be binding upon, inure to the benefit of, and be enforceable by the Grantee, the Third Party Beneficiaries and their respective successors and assigns. Non-use or limited use of the easement rights granted in this Agreement shall not prevent the benefiting party from later use of the rights to the fullest extent authorized in this Agreement.

(i) Rule Against Perpetuities: In the event it shall have been determined by a court of competent jurisdiction that any of the interests conveyed or assigned or purported to be conveyed or assigned herein are void as against any rule against perpetuities or Chapter 700 of the Wisconsin Statutes, or its successor, the life or lives of such interest or interests shall be deemed without any further action on the part of any party to be the longest life or lives possible without violation of any such rule or statute, as it is the intention of the parties hereto that the interest conveyed herein shall not be in violation of any such rule or statute.

TO HAVE AND TO HOLD unto the Grantee and its assigns forever.

IN WITNESS WHEREOF, the parties hereto, which may be represented by and through their appointed counsel, enter into this Agreement. Each person signing this Agreement represents and warrants that he or she has the full power and authority to enter into this Agreement.

Kenneth J. Lemberger, Owner — Date 5/20/2009

LEMBERGER SITES REMEDIATION GROUP

By: Douglas B. Clark, Agent — Date 5-20-09

VOL 2468 PG 303

STATE OF WISCONSIN)
) ss.
COUNTY OF DANE)

Personally came before me this 20th day of May, 2009, the above-named Kenneth J. Lemberger, to me known to be the person who executed the foregoing ~~instrument and~~ acknowledge that he executed the same.

Deborah A. Taugher
Notary Public, Dane County, Wisconsin
My commission expires January 6, 2013

STATE OF WISCONSIN)
) ss.
COUNTY OF DANE)

Personally came before me this 20th day of May, 2009, the above named Douglas B. Clark, to me known to be the agent of Lemberger Sites Remediation Group and the person who executed the foregoing instrument and acknowledge that he/she executed the same on behalf of said entity by its authority.

Deborah A. Taugher
Notary Public, Dane County, Wisconsin
My commission expires January 6, 2013

Attachments: Exhibit A-Legal description of the Property

EXHIBIT A

Legal Description of Property

<u>The Property that is the subject of this Environmental Protection Easement and Declaration of Restrictive Covenants is limited to the property that lies within the fences that surround the two Parcels described below:</u>

<u>Parcel 1:</u>

The Northeast Quarter (NE 1/4) of the Southeast Quarter (SE 1/4) of Section Numbered Twenty-seven (27) Township Numbered Twenty (20) North, Range Numbered Twenty-two (22) East, in the Town of Franklin Manitowoc County, Wisconsin.

Parcel No.: 005-027-013-000.00

<u>Parcel 2:</u>

The East One-half (E 1/2) of the East One-half (E 1/2) of the Northwest Quarter (NW 1/4) of the Northeast Quarter (NE 1/4) of Section Numbered Thirty-four (34), Township Numbered Twenty (20) North, Range Numbered Twenty-two (22) East, in the Town of Franklin, Manitowoc County, Wisconsin.

Parcel No.: Part of 005-034-002-001.00

<u>Parcel 3</u>:

The West One-half (1/2) of the Northeast Quarter (NE 1/4) of the Northeast Quarter (NE 1/4); and the West One-half (W 1/2) of the East One-half (E 1/2) of the Northeast Quarter (NE 1/4) of the Northeast Quarter (NE 1/4), of Section Numbered Thirty-four (34), Township Numbered Twenty (20) North, Range Numbered Twenty-two (22) East, in the Town of Franklin, Manitowoc County, Wisconsin.

Parcel No.: Part of 005-034-001-000.00

VOL 2468 PG 305

Document Number

DOC # 1065460

ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANTS

STATE OF WI - MTWC CO
PRESTON JONES REG/DEEDS
RECEIVED FOR RECORD
05/28/2009 9:35:42 AM

This Environmental Protection Easement and Declaration of Restrictive Covenants (the "Agreement") is made this 20th day of May 2009, by and between Terrance C. Lemberger (the "Grantor") and the Lemberger Sites Remediation Group ("LSRG") ("the Grantee"). The Grantor and Grantee intend that the provisions of this Agreement also be for the benefit of the Wisconsin Department of Natural Resources ("WDNR") and the United States. WDNR and the United States are hereinafter referred to as the "Third Party Beneficiaries."

Drafted by and after recording return to:
Attorney Douglas B. Clark Foley & Lardner LLP P. O. Box 1497 Madison, WI 53701-1497
Part of 005-034-004-001.00 and Part of 005-034-003-000.00
Parcel Identification Number(s)
25clk

WITNESSETH:

WHEREAS, Grantor is the owner of certain land in Manitowoc County, Wisconsin, more particularly described on Exhibit A attached hereto and made a part hereof (the "Property");

WHEREAS, the LSRG is comprised of the City of Manitowoc, Manitowoc Company, Manitowoc Public Utilities, Newell Company, and Red Arrow Products Company, LLC.

WHEREAS, the WDNR is acquiring this interest pursuant to Wisconsin Statutes Sec. 292.31.

WHEREAS, the Property is part of the Lemberger Transport Recycling ("LTR") Superfund site located near the Village of Whitelaw, which has been listed on the National Priority List under the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA");

WHEREAS, the Owner and the LSRG previously executed an Access and Easement Agreement dated May 11, 2005 (the "Prior Agreement") that specified the conditions upon which the LSRG was granted unrestricted, continuous and permanent access to the Property for itself, for the United States Environmental Protection Agency ("U.S. EPA"), for the WDNR, and each of their contractors, consultants and representatives;

WHEREAS, pursuant to the Prior Agreement, the LSRG has been investigating and remediating hazardous substance contamination and restoring the LTR site (the "Remediation") under the direction of the U.S. EPA and the WDNR, pursuant to Consent Decree No. 92-C-0583

(E.D. Wis. 1992) (the "Consent Decree") and the Administrative Order by Consent No. V-W-93-C-196 (U.S. EPA Region V, 1993) (the "AOC");

WHEREAS, the parties wish to reaffirm the Prior Agreement in its entirety and to clarify and agree to the following: (1) to grant a permanent right of access over the Property to the Grantee for purposes of implementing, facilitating and monitoring the remedial action; and (2) to impose on the Property use restrictions as covenants that will run with the land for the purpose of protecting human health and the environment; and

WHEREAS, Grantor wishes to cooperate with the Grantee in the implementation of all response actions at the Site.

NOW, THEREFORE:

1. Grant: Grantor, on behalf of itself, its successors and assigns, and in consideration of the terms of the Consent Decree and the AOC, does hereby covenant and declare that the Property shall be subject to the restrictions set forth herein. Furthermore, Grantor, on behalf of itself, its successors and assigns, and in consideration of the terms of the Consent Decree and the AOC, does give, grant and convey to the Grantee, and its assigns, (1) the perpetual right to enforce said use restrictions, and (2) an environmental protection easement of the nature and character, and for the purposes explained in this Agreement, with respect to the Property.

2. Purpose: It is the purpose of this Agreement to convey to the Grantee rights to facilitate the remediation of past environmental contamination and to protect human health and the environment by reducing the risk of exposure to contaminants. It is also the purpose of this Agreement that the Third Party Beneficiaries shall have the right to enforce the terms of this Agreement.

3. Third Party Beneficiaries: Grantor and Grantee, on behalf of themselves and their successors, transferees and assigns, hereby agree that the WDNR and the United States, together with their successors and assigns, are the intended third party beneficiaries of all the benefits and rights conveyed to the Grantee under this Agreement.

4. Restrictions on use: The following covenants, conditions, and restrictions apply to the use of the Property for the benefit of the Grantee and the Third Party Beneficiaries and are binding upon the Grantor including its successors, transferees, assigns or other person acquiring an interest in the Property and their authorized agents, employees, or persons acting under their direction and control.

(a) Groundwater underlying the Property shall not be extracted, consumed, exposed or utilized in any way, except for the limited purpose of treating and monitoring groundwater contamination levels in accordance with plans approved by the U.S. EPA.

(b) There shall be no disturbance of the surface or subsurface of the land in any manner, including but not limited to filling, drilling, excavation, removal of topsoil, rock or minerals, or change of the topography in any manner.

5. Modification of restrictions: Any request for modification or rescission of this Agreement shall be made to the Grantee, the WDNR and the U.S. EPA at the addresses given below. This Agreement may be modified or rescinded only with the written approval of the U.S. EPA Superfund Division Director and the Director of the WDNR. Grantor, on behalf of its successors, transferees, assigns or other person acquiring an interest in the Property, agrees to file any U.S. EPA approved and WDNR approved modification to or rescission of the Agreement with the appropriate Registrar of Deeds and a certified copy shall be returned to the U.S. EPA and the WDNR at the addresses listed below.

6. Environmental Protection Easement: Grantor hereby conveys and grants to the LSRG, to the Grantee, to the Third Party Beneficiaries and to their contractors, consultants and representatives, an irrevocable, permanent and continuing environmental protection easement for access to and use of, at all reasonable times, the Property for purposes of: (i) preparing for and conducting the Remediation, including but not limited to the construction, operation and maintenance of a groundwater treatment system, a portion of which may be located on the Property and (ii) any other purpose deemed reasonably necessary by the LSRG, U.S. EPA, and/or WDNR, pursuant to the Consent Decree, the AOC, and the Prior Agreements. Subparagraph (ii) shall not be interpreted to expand the purposes for which this easement is given, but shall be interpreted to be consistent with subparagraph (i) and the purpose for which this easement is needed.

7. No Ownership. This Agreement shall not be interpreted as conveying to the LSRG, or any other party, any ownership rights to the Property. This Agreement shall not be interpreted as changing any of the provisions of the Prior Agreements. Grantor acknowledges that it has already agreed to refrain from activity on the Property that could negatively affect the LSRG's remediation efforts or exacerbate the soil or groundwater contamination at or in the vicinity of the LL or LTR sites.

8. Reservation of Legal Rights. Nothing in this Agreement shall limit or otherwise affect U.S. EPA's rights of entry and access or U.S. EPA's authority to take response actions under CERCLA, the NCP, or other federal law, statute, rule or administrative order.

9. No Public Access and Use: No right of access or use by the general public to any portion of the Property is conveyed by this Agreement.

10. Notice requirement: Grantor agrees to include in any instrument conveying any interest in any portion of the Property, including but not limited to deeds, leases, easements, licenses and mortgages, a notice which is in substantially the following form:

> **NOTICE: THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANTS IN FAVOR OF, AND ENFORCEABLE BY THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES AND THE UNITED STATES OF AMERICA AS THIRD PARTY BENEFICIARIES.**

Within thirty (30) days of the date any such instrument of conveyance is executed, Grantor must provide Grantee with a certified copy of said instrument and, if it has been recorded in the public land records, its recording reference.

11. <u>Administrative jurisdiction:</u> The federal agency having administrative jurisdiction over the interests acquired by the United States by this Agreement is the U.S. EPA. The WDNR has administrative jurisdiction over the interests acquired by this Agreement.

12. <u>Enforcement:</u> Grantee and Third Party Beneficiaries shall be entitled to enforce the terms of this Agreement by resort to specific performance or legal process. All remedies available hereunder shall be in addition to any and all other remedies at law or in equity, including CERCLA. Enforcement of the terms of this Agreement shall be at the discretion of the Grantee, and any forbearance, delay or omission to exercise its rights under this Agreement in the event of a breach of any term of this Agreement shall not be deemed to be a waiver by the Grantee of such term or of any subsequent breach of the same or any other term, or of any of the rights of the Grantee under this Agreement.

13. <u>Covenants:</u> Grantor hereby covenants to and with the Grantee and the Third Party Beneficiaries, that the Grantor is the lawful fee simple owner of the Property.

14. <u>Notices:</u> Any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other shall be in writing and shall either be served personally or sent by first class mail, postage prepaid, addressed as follows:

<u>To Grantor</u>:

Terrance C. Lemberger
14006 County Trunk Highway K
Reedsville, WI 54230

<u>To Third Party Beneficiary</u>:

Wisconsin Dept. of Natural Resources
101 South Webster Street
Madison, WI 53703

<u>To Third Party Beneficiary</u>:

U.S. Environmental Protection Agency
Region Five Administrator
77 West Jackson Boulevard
Chicago, IL 60604

<u>To LSRG</u>:

Douglas B. Clark
Foley & Lardner LLP
150 East Gilman Street
Madison, WI 53703
(608) 258-4276

15. <u>General provisions</u>:

(a) Controlling law: The interpretation and performance of this Agreement shall be governed by the laws of the United States or, if there are no applicable federal laws, by the law of the State of Wisconsin.

(b) Liberal construction: Any general rule of construction to the contrary notwithstanding, this Agreement shall be liberally construed in favor of the grant to effect the purpose of this Agreement and the policy and purpose of CERCLA. If any provision of this

Agreement is found to be ambiguous, an interpretation consistent with the purpose of this Agreement that would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability: If any provision of this Agreement, or the application of it to any person or circumstance, is found to be invalid, the remainder of the provisions of this instrument, or the application of such provisions to persons or circumstances other than those to which it is found to be invalid, as the case may be, shall not be affected thereby.

(d) Entire Agreement: This Agreement sets forth the entire agreement of the parties with respect to rights and restrictions created hereby, and supersedes all prior discussions, negotiations, understandings, or agreements relating thereto, all of which are merged herein, except that unless expressly modified or amended herein, nothing in this Agreement is intended or shall be deemed to supersede, replace or amend the Prior Agreement, which remains in full effect and is are legally binding on both parties.

(e) No Forfeiture: Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

(f) Termination of Rights and Obligations: A party's rights and obligations under this Agreement terminate upon transfer of the party's interest in the Easement or Property, except that liability for acts or omissions occurring prior to transfer shall survive transfer.

(g) Counterparts: The parties may execute this Agreement in two or more counterparts, which shall, in the aggregate, be signed by both parties; each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling.

(h) Binding Effect: All of the terms and conditions in this Agreement, including the benefits and burdens, shall run with the land as to the Property and shall be binding upon, inure to the benefit of, and be enforceable by the Grantee, the Third Party Beneficiaries and their respective successors and assigns. Non-use or limited use of the easement rights granted in this Agreement shall not prevent the benefiting party from later use of the rights to the fullest extent authorized in this Agreement.

(i) Rule Against Perpetuities: In the event it shall have been determined by a court of competent jurisdiction that any of the interests conveyed or assigned or purported to be conveyed or assigned herein are void as against any rule against perpetuities or Chapter 700 of the Wisconsin Statutes, or its successor, the life or lives of such interest or interests shall be deemed without any further action on the part of any party to be the longest life or lives possible without violation of any such rule or statute, as it is the intention of the parties hereto that the interest conveyed herein shall not be in violation of any such rule or statute.

TO HAVE AND TO HOLD unto the Grantee and its assigns forever.

IN WITNESS WHEREOF, the parties hereto, which may be represented by and through their appointed counsel, enter into this Agreement. Each person signing this Agreement represents and warrants that he or she has the full power and authority to enter into this Agreement.

Terrance C. Lemberger
Terrance C. Lemberger, Owner

5/20/09
Date

LEMBERGER SITES REMEDIATION GROUP

By: Douglas B. Clark
Douglas B. Clark, Agent

5/20/09
Date

VOL 2468 PG 311

STATE OF WISCONSIN)
) ss.
DANE COUNTY)

Personally came before me this 20th day of May, 2009, the above-named Terrance C. Lemberger, to me known to be the person who executed the foregoing instrument and acknowledge that he executed the same.

Deborah A. Taugher
Notary Public, Dane County, Wisconsin
My commission expires January 6, 2013

STATE OF WISCONSIN)
) ss.
COUNTY OF DANE)

Personally came before me this 20th day of May, 2009, the above named Douglas B. Clark, to me known to be the agent of Lemberger Sites Remediation Group and the person who executed the foregoing instrument and acknowledge that he/she executed the same on behalf of said entity by its authority.

Deborah A. Taugher
Notary Public, Dane County, Wisconsin
My commission expires January 6, 2013

Attachments: Exhibit A-Legal description of the Property

EXHIBIT A

Legal Description of Property

The Property that is the subject of this Environmental Protection Easement and Declaration of Restrictive Covenants is limited to the property that lies within the fence at the LTR site as described below:

A parcel of approximately five (5) acres that includes:

(1) All except the East (E) Two Hundred and Fifty (250) feet of the North One-half (N ½) of the North One-half (N ½) of the North One-half (N ½) of the Southeast One-quarter (SE ¼) of the Northeast One-quarter (NE ¼) of Section Numbered Thirty-four (34), Township Numbered Twenty (20) North, Range Numbered Twenty-two (22) East, in the Town of Franklin Manitowoc County, Wisconsin.

Tax Parcel No: Part of 005-034-004-001.00

and

(2) The North One-half (N ½) of the North One-half (N ½) of the North One-half (N ½) of the East (E) Two Hundred and Fifty (250) feet of the Southwest One-quarter (SW ¼), of the Northeast One-quarter (NE ¼) of Section Numbered Thirty-four (34), Township Numbered Twenty (20) North, Range Numbered Twenty-two (22) East, in the Town of Franklin Manitowoc County, Wisconsin.

Tax Parcel No: Part of 005-034-003-000.00

Exhibit 21:

UWGB researchers to explore what's behind kids' 'thrill

BY SCOTT WILLIAMS
Gannett Wisconsin Media

Kids bludgeoning raccoons with golf clubs. Snowmobilers running down whitetail deer.

How could anyone be so cruel?

That is the question researchers at the University of Wisconsin-Green Bay hope to answer. And in their study on "thrill killing" of wildlife, researchers are going straight to the perpetrators.

Ray Hutchison and Karen Dalke, faculty members in the UWGB Department of Urban and Regional Studies, are focusing their exploratory research on why young people, in particular, engage in thrill killing.

Drawing on incidents that have occurred in Wisconsin in recent years, researchers are attempting to interview participants to find out what motivated them.

The researchers, who have studied street gangs in the past, said they are fascinated by the psychological and sociological questions raised by thrill killing.

"You wonder, 'How could somebody do that? Why would somebody do that?'" Hutchison said. "And those are actually good research questions."

The UWGB faculty members have received a research grant of $18,000 from the state Department of Natural Resources, which has investigated several thrill killings in recent years.

The term refers to the killing of wildlife, often in large numbers and by groups of people, in violation of state hunting rules and without harvesting the dead animals for food or sport.

Deer, turkey, opossum and other animals have been attacked with golf clubs, hockey sticks, baseball bats and bows and arrows.

The vast majority of incidents recorded by the DNR have involved perpetrators in their early 20s or younger.

In Manitowoc County, for example, authorities in 2006 prosecuted several Kiel High School students who had organized raccoon killings in a group that called itself the "Coon Patrol." DNR investigators found that the raccoon hunts were a tradition among Kiel teenagers for several years and that participants had printed T-shirts for the occasion.

Chuck Horn, a state game warden working with the UWGB researchers, said he hopes the findings point to solutions for steering kids away from such destructive behavior.

Horn said he has identified at least 13 past thrill killing perpetrators who appear willing to cooperate with the project.

"I think deep down they have a sense of responsibility and maybe are trying to make amends," he said.

Hutchison and Dalke began by surveying 500 students at UWGB to gauge young peoples' attitudes overall toward animals and hunting.

The faculty members hope to release the results of their study by summer.

The research findings could shed light on a phe- nome[...] hunte[...] said J[...] dent o[...] ed, a based ...

Despite enforcement efforts by the DNR and others, Schinkten said, he believes thrill killings continue. Hunters occasionally come across evidence in the field, such as dead deer or other wildlife that have been abandoned.

"I don't understand it, don't pretend to understand it," Schinkten said. "It's a sad state of affairs — that's for sure."

Scott Williams writes for the Green Bay Press-Gazette.

HEART

From A-1

An angiogram revealed mild narrowing that was not significant enough to warrant another stent, Gentile said.

Unfortunately, her jaw pressure continued.

"I was suspicious that we were missing something with the angiogram," said Gentile, who wanted Berzinsky to have an intravascular ultrasound, which could confirm or deny the presence of plaque.

"We brought the machine in as a trial to evaluate if we should purchase it," said Michael Wellner, HFM director of cardiovascular services. "We used it multiple times while it was here. We came to the conclusion that it was beneficial in diagnosing heart disease and having better outcomes. We saw things we didn't see before."

An angiogram takes two-dimensional images of the artery from the outside and, depending on where the plaque is located, can produce deceivingly normal images, Gentile said.

The intravascular ultrasound, which the hospital purchased about six months ago, is a way to look at the vessel from inside. It uses an ultrasound catheter, about the size of a large pencil lead, which is usually inserted through the femoral artery in the groin. It rotates inside the artery and uses sound waves to take three-dimensional images, which are transmitted to a monitor.

Doctors can then see plaque, composed of cholesterol, cells and inflammatory agents, which causes arteries to narrow and close, reducing the blood flow to the heart and potentially leading to a heart attack, Gentile said.

Typical heart attack symptoms include chest pain, shortness of breath and fatigue. Women can experience heart attack differently with symptoms including jaw pain, pain in one arm or mid-back, and indigestion or heartburn with exertion, he said.

Sometimes they experience no pain at all, Wellner said.

Berzinsky's ultrasound revealed significant narrowing of a main artery and she ended up receiving another stent in June, followed by 12 weeks of rehabilitation.

"It certainly improved her symptoms," Gentile said.

She can now take pain-free walks and lead a more active life.

"I just feel great because they found what was wrong ... I don't get the jaw pressure anymore," Berzinsky said. "I'm very grateful they were able to take care of that problem."

Suzanne Weiss, (920) 686-2140 or sweiss@htrnews.com

STURGEON

From A-1

Water clarity is a major factor in the spearers' success. Spearers on Saturday reported clear water down to 16 feet or more on the north end of the lake, but there were reports of cloudy water (likely caused by thawing temperatures several weeks ago) on southern parts of the lake.

Grishaber, 60, of Appleton said he could not see his record fish when he speared it; he only saw the shadow of it as it passed over white PVC pipe markers he put on the bottom 16 feet below, plus one small fin.

Although Grishaber's fish has not been aged, Bruch estimated it was at least 100 years old. Biologists will slice a section of a fin for examination to determine age.

Bruch said it would have hatched about 1910 and faced spearers 78 seasons since 1932, when a season was established after all spearing had been banned for 17 years. He estimates it produced more than 11 million eggs in its lifetime and made 19 trips up and down the Wolf River (adult females spawn about every four years) during that time.

DNR staff in airplanes tallied 4,033 spearing shanties Saturday on Lake Winnebago and 4,009 Sunday, while they counted 490 on the upriver lakes Saturday and 469 Sunday.

Last year's total of 6,853 shanties set a record.

Spearing sturgeon is a waiting game, and many anglers spend years staring down their 4-by-8 foot holes in the ice without seeing a fish.

Debbie Karau of Oshkosh was elated, not because she bagged a fish, but because she saw one Sunday — the first live one she had seen in eight years of spearing.

"We saw it. It was gigantic!" Karau said. "It came out from under me (below the shanty floor)."

She and her friend Cindy Rank of Oshkosh were both spearing from the shanty when the estimated 5-foot fish moved toward their decoy about 7 feet down. They were spearing northeast of Big Island near Wendt's on the Lake bar and restaurant south of Oshkosh.

"She (Rank) grabbed the spear, but I think the fish saw the spear moving," Karau said.

Rank threw her spear, but missed. Despite the errant shot, Karau was pumped.

"I can't wait for tomorrow," she said.

Ross Bielema is a freelance writer from New London.

OWI

From A-1

Cahak's family settled a wrongful death civil lawsuit against Lepich and his insurance carrier.

'Drugged driving' law

The "Baby Luke Law" was enacted in December 2003, two months after Lepich's accident, after a man who drove with cocaine in his blood struck another vehicle driven by a pregnant woman in Milwaukee. The child died from the crash.

The law prohibits driving with any detectable amount of an illegal drug in a person's system. Now officers have to prove only that drivers have an illegal drug in their system rather than having to prove actual impairment, according to a 2003 traffic safety publication from the state Department of Transportation.

Drivers who exhibit symptoms indicative of drug use have to submit to a blood test. Refusing it carries the same penalties as refusing to take an alcohol test — automatic driver's license revocation, the report said.

Megan Schmidt: (920) 686-2105 or meschmidt@htrnews.com

WASHINGTON JUNIOR HIGH SCHOOL HONOR ROLL

Herald Times Reporter

MANITOWOC — The following students were named to the honor roll for the second quarter of the 2009-10 school year at Washington Junior High School.

A honor roll

The following students achieved at least a 3.5 grade-point average. An asterisk denotes a 4.0 grade-point average.

Grade 7: *Ellie Brockman, Romeao Cavitt, Billy Chang, Spencer Couser, Emily Curran, *Angelica Damp, April Eisenschink, Marissa Forster, Emily Gamez-Khail, *Mason Gollata, *Jaydin Grenier, *Nicholas Grotgut, Justin Havel, Jenna Heili, *Paige Heinzen, Preston Heinzen, *Cody Hoffman, *Kevin Hofmann, Brogan Jindra, Cristina Johnson, Kersten Kielsmeier, Tyler Klackner, Justin Klein, Derek Knorr, Jade Kono, Emily Kretsch, Austin Krueger, Vixay Kue, *Brent Landon, Billy Lee, Anthony Loiselle, Stephanie Lutz, Jasmine Medukas, Nicholas Mraz, Devon Nelson, Michael Nessman, Michael Nitka, *Kaitlyn Popp, Nicholas Qualman, Sharee Radke, Ruth Rehme, Peyton Resch, Bryce Retzloff, Corinna Riske, Ryan Specht, Elliott Stock, *Nicholas Stone, Tommy Thammavong, Jerry Thao, Ninah Thao, *Tyler Thiers, *Victoria Vang, *Ashley Wachholz, Chee Xiong, Teng Xiong, *Timothy Xiong, Aysha Yang, Emily Yang

Grade 8: Deja Anhalt, *Mitchell Belisle, Alexandria Bolle, *Lainey Braun, *Brianna Braunel, Connor Drewieske, *Chelsey Duellman, *Courtney Fish, *Ashley Ford, Brittany Gallas, Mariana Garcia, *Justin Gomm, Alyssa Grotegut, Kasey Hadler, Justin Hafeman, Cindy Hang, Kong Hang, Samantha Hang, Angel Her, Olivia Hubbartt, Caleb Jablonicky, *Galena Jacquart, Taylor Khail, Brianna Kubec, *Danielle Kubichek, Khaqhovia Lee, Tou Jim-Lee, Ryan Luebke, *Brennan Lutz, *Gabriella Medina, Justin Meinnert, Gabriela Najera-Cabrera, Rose Neff, *David Pankratz, Anna Patsakham, Marissa Pierce, Tyler Pribyl, Josie Prickett, *Brandon Rehme, Abigail Reinke, Logan Rooney, *Karly Rosinsky, *Carl Samz, Collin Saubert, *Alayna Sbar, Sierra Schleusner, Lydia Snyder, *April Thao, Alisha Theis, Brian Tlachac, Joshua Tyson, *Adam Vandenhouten, Doa Vang, Shoua Vang, Devin Ward, Anne Wright, Arnie Xiong, *Tiffany Xiong, *Hlee Yang

Grade 9: *Katelyn Backhaus, Elizabeth Barry, Alone Chanthavong, Amanda Denault, Alec Dose, Nicollette Gretz, *Ashley Hallfrisch, Nancy Hang, Jasmine Hartlaub, *Sawyer Hungerford, Autum Jacquart, Tyler Jasper, Dee Dee Jolin, Bryan Kelly, Angela Knorr, Mitchell Koch, Ryan Kraemer, Lucas LaPlante, *Autumn Linsmeier, Allison Luckow, Derek Lukes-York, Marissa Martell, *Cheyenne Mueller, Asari Nava, Carrie O'Connor, Jacob Opperman, Lily Phajit, Amy Rutherford, Carly Seefeldt, Elizabeth Shavlik, Riley Spiering, *Hannah Strauss, Nicole Temme, *Charlie Thao, Tom Thao, Ryan Van Ells, Akelia Vang, Dragana Vlaski, Jerrid Wavrunek, *Alyssa Wigand, Foua Xiong, Choua Yang, Michelle Yang, Poua Yang, Michael Zewicki

B honor roll

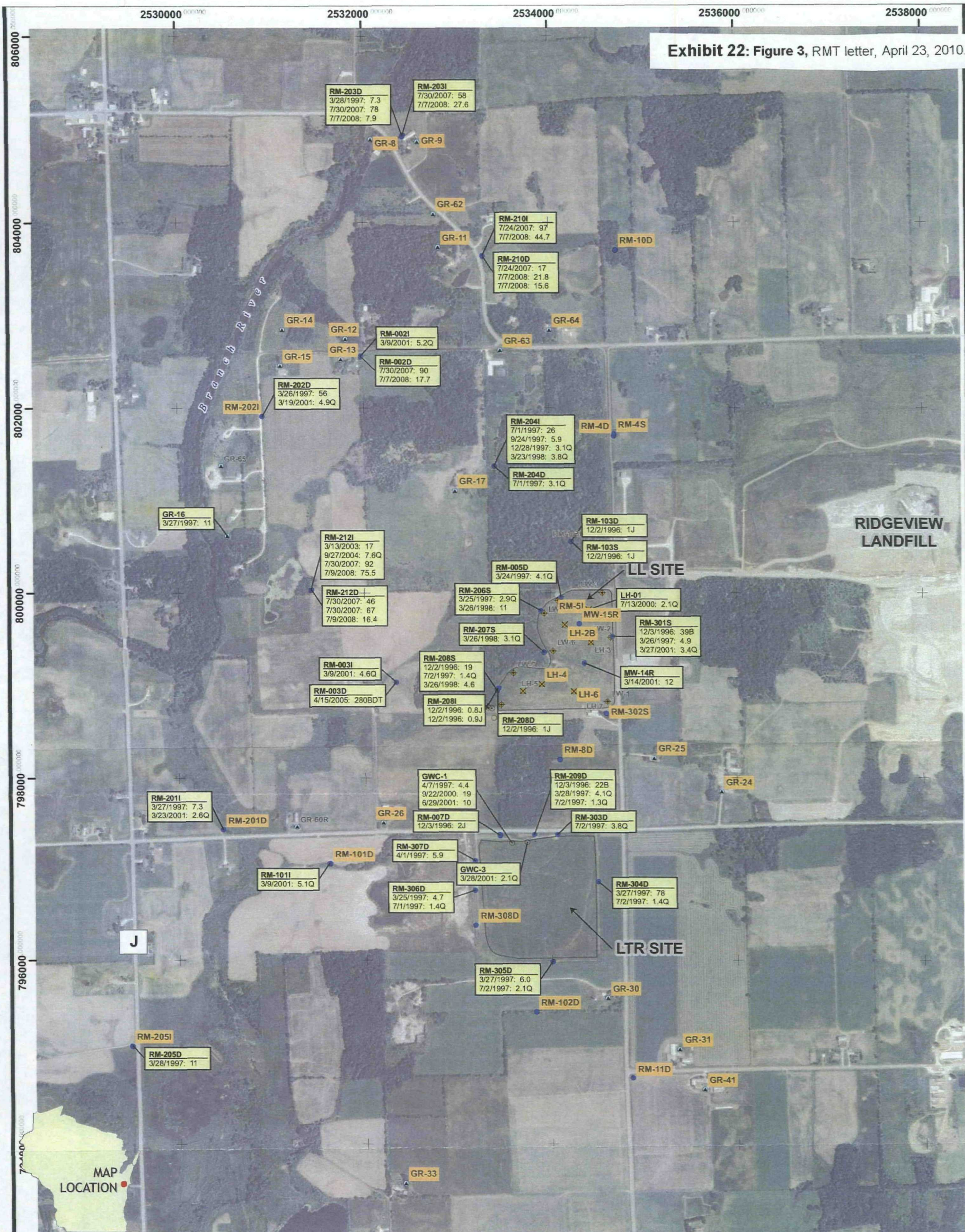
The following students achieved a grade-point average of 3.0 to 3.499.

Grade 7: Heather Baeckmann, Summer Basler, Galena Baumann, Matthew Bialek, Dominic Bordeau, Zachary Braun, Nadine Corrigall, Jacob DuPont, Micah Gonzalez, Tori Graff, Kong Hang, Austyn Holschbach, Joshua Howarth, Jackson Huycke, Taliyah Jackson, Samantha Kaufman, Tiffany Kue, Jordan Levendusky, Jonathon McConnell, Angel Medina, Ricky Morado, Hannah Moreno, Maureen O'Leary, Marissa Plate, [...] Ramirez, Reyna Robles, Kimberly Rodriguez, Brandon Schmoock, Alissa Seal, David Sharpe, Marina Skrepenski, Harley Stenzel, Brady Strauss, Shia Thao, See Vang, Christopher Waite, Darek Ward, Bryanna Wetzel, Marriah Whalen, Chaseng Xiong, Pa Nhia Xiong, Yer Xiong

Grade 8: Autumn Basler, Quinlyn Boonperm, Brandon Butz, Eydi Cedano, Kamber Duellman, Rachel Elliott, Alex Emme, Winston Filipek, Stephanie Galien, Hailey Gamez, Jared Gass, Brooklyne Giles, Terry Goins, Jose Gonzalez, Chor Hang, Choua Hang, Chue Xang Hang, Michael Horstketter, Kendra Kelpe, Andrew Kumbalek, Wesley Lodel, Rosa Mena, Paul Missouri, Destiny Mott, Jessica Mrotek, Eric Owald, Cassidy Pangburn, Kaila Reznichek, Cheyenne Sebo, Wendy Vang, Jordan Velez, Christopher Wittmus, Mee Xiong, Megan Xiong, Yay Xiong, Jason Yang, Zachary Zahn

Grade 9: Danielle Backus, Jasmine Bohlman, Kylie Bowman, Trevor Brault, Summer Castro, Jimmy Chang, Cassandra Clarksen, Olivia Clifton, Jeffrey Erdman, Sydney Fabian, Kayla Flentje, Benjamin Gunzel, Katherine Hafemeister, Alexandra Hang, Cynthia Hang, Danby Hang, Lue Hang, Mary Hang, Bryce Heinzen, Miranda Kaufman, Devin Kosarzycki, Ashley Kotila, Heather Kunesh, Brittney LaPlante, Erica Lee, Brandon Lesperance, Angel Lopez, Lexie Mertens, Vanessa Nessman, Katie Ouradnik, Hailey Sadowski, Alex Shimon, Micheal Stites, Chueyee Thao, Kyle Thomas, Nikala Valdez, Cassidy Waite, Landon West, Dalen Xiong, Fue [...]

Exhibit 22: Figure 3, RMT letter, April 23, 2010.



LEGEND

LANDFILL AREA

SAMPLE AND MONITORING LOCATIONS

- BEDROCK BORING
- GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- MONITORING WELL (RM)
- RESIDENTIAL WELL (GW)

LABEL FORMAT

SAMPLE ID
Sample Date: DEHP Con. [µg/L]

RM-102D — WELL SAMPLED BUT NO DEHP DETECTED

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2008.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. RESULTS SHOWN FOR BIS(2-ETHYLHEXYL)PHTHALATE (DEHP) ARE SHOWN IN µg/L.
4. HIGHLIGHTED WELLS' NAMES HAVE BEEN SAMPLED BUT DEHP WAS NOT DETECTED.
5. MONITORING WELL DATA ONLY.

N

0 1,000 FEET

1" = 1,000'

1:12,000

PROJECT: **LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**

SHEET TITLE: **HISTORIC GROUNDWATER ANALYTICAL RESULTS FOR BIS(2-ETHYLHEXYL)PHTHALATE (DEHP)**

DRAWN BY:	PAPEZ J	SCALE:		PROJ. NO.	00-03458.46
CHECKED BY:	WEDEKIND J		AS NOTED	FILE NO.	34584605.mxd
APPROVED BY:	KRAUSE K	DATE PRINTED:		**FIGURE 3**	
DATE:	MARCH 2010		3/8/2010		

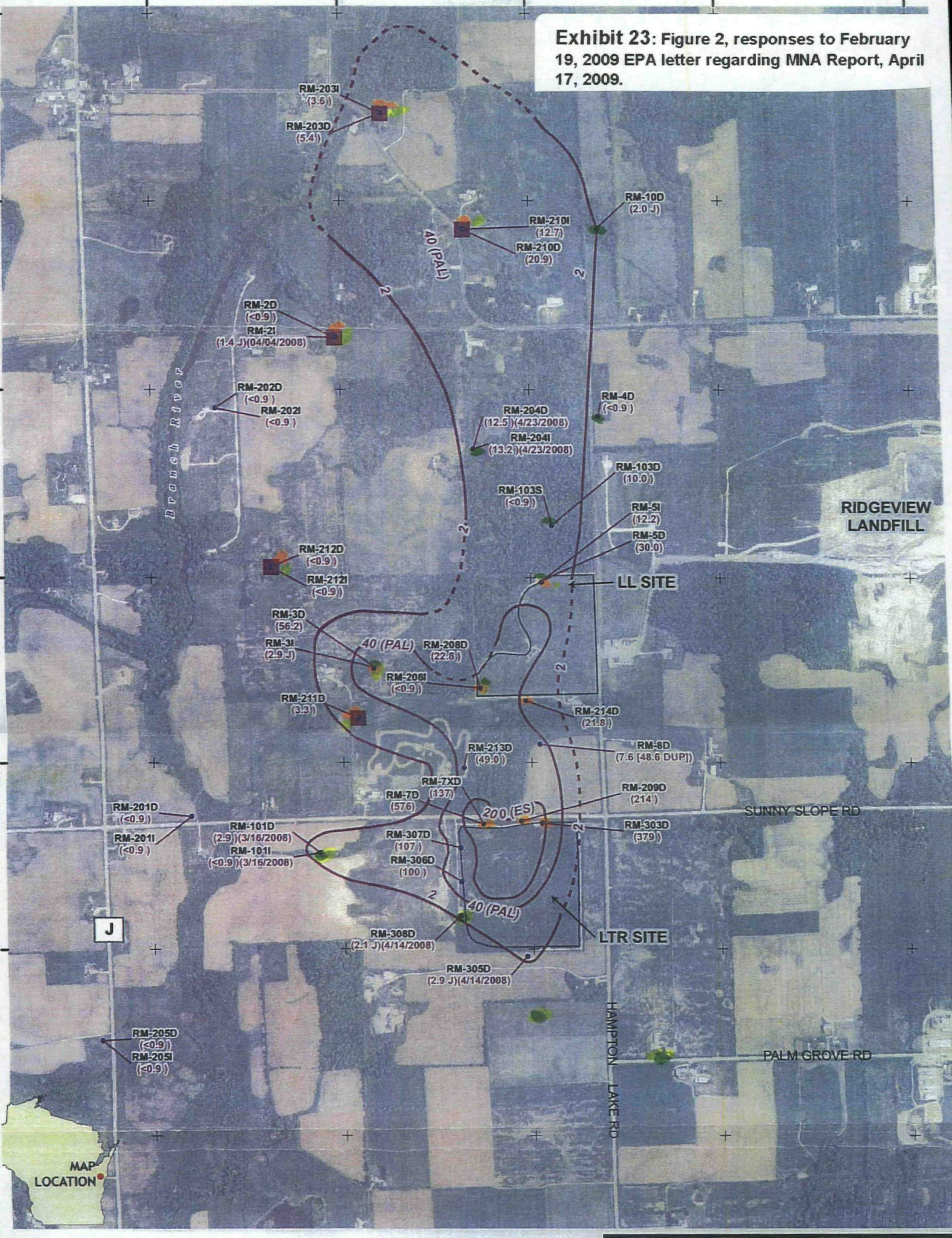
RMT

744 Heartland Trail
Madison, WI 53717-1934

P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

D:\03458\46\MXD\34584605.mxd 3/8/2010 16:58:06

Exhibit 23: Figure 2, responses to February 19, 2009 EPA letter regarding MNA Report, April 17, 2009.



LEGEND

- MONITORING WELL
- SENTINEL WELLS
- 20 — 1,1,1-TCA ISO-CONCENTRATION *(DASHED WHERE INFERRED)*

1,1,1-TCA SAMPLES USED FOR ISO-LINES *LABELS SHOW CONCENTRATION (UG/L) AND SAMPLE DATE IF SAMPLE WAS TAKEN EARLIER THAN JULY 2008*

RM-208
(825.53)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. J OR Q = RESULT IS BETWEEN THE LOD AND LOQ.
4. 1,1,1-TCA WAS NOT DETECTED IN RESIDENTIAL WELL SAMPLES DURING THE REPORTING PERIOD; RESIDENTIAL WELL RESULTS ARE NOT USED FOR CONTOURING.

N

0 1,000 FEET
1" = 1,000'
1:12,000

PROJECT: LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN			
SHEET TITLE: 1,1,1-TCA CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008			
DRAWN BY: MCKEEFRY J	SCALE:	PROJ. NO.	00-03457.46
CHECKED BY: THC	AS NOTED	FILE NO.	34574606.mxd
APPROVED BY: JDW	DATE PRINTED: 12/22/2008	FIGURE 2	
DATE: DECEMBER 2008			

RMT

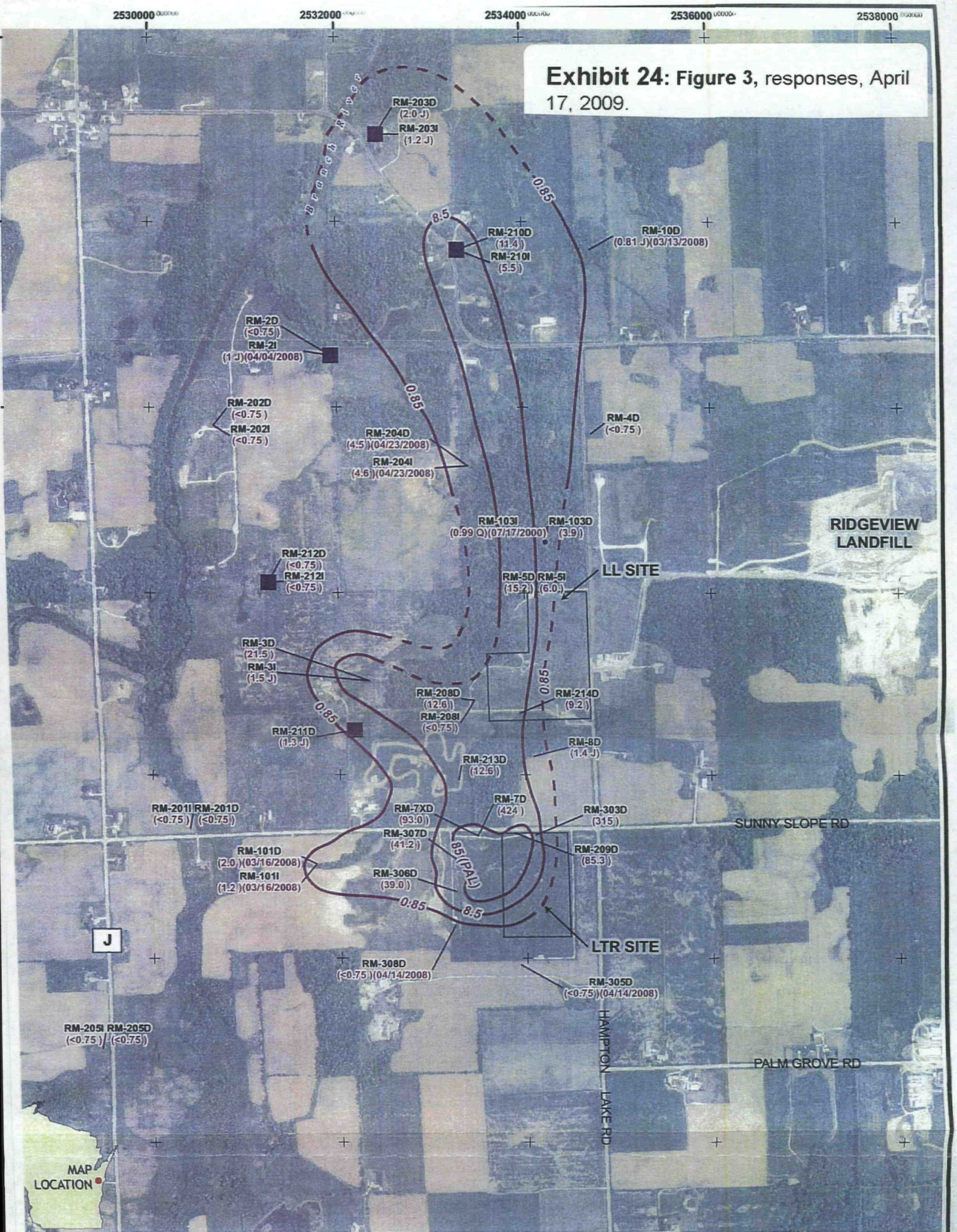
744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

I57\46\mxd\34574606.mxd 12/22/2008 11:02:22

Proposed quarterly sampling [illegible]

Proposed semi-annual sampling

Exhibit 24: **Figure 3**, responses, April 17, 2009.



GEND

- MONITORING WELL
- SENTINEL WELLS
- 1,1-DCA ISO-CONCENTRATION (DASHED WHERE INFERRED)

)CA SAMPLES USED FOR ISO-LINES
ELS SHOW CONCENTRATION (UG/L) AND
PLE DATE IF SAMPLE WAS TAKEN EARLIER
N JULY 2008

RM-212D
(<0.48)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. J OR Q = RESULT IS BETWEEN THE LOD AND LOQ.
4. 1,1-DCA WAS NOT DETECTED IN RESIDENTIAL WELL SAMPLES DURING THE REPORTING PERIOD; RESIDENTIAL WELL RESULTS ARE NOT USED FOR CONTOURING.

0 1,000 FEET
1" = 1,000'
1:12,000
N

PROJECT: LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN

SHEET TITLE: 1,1-DCA CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008

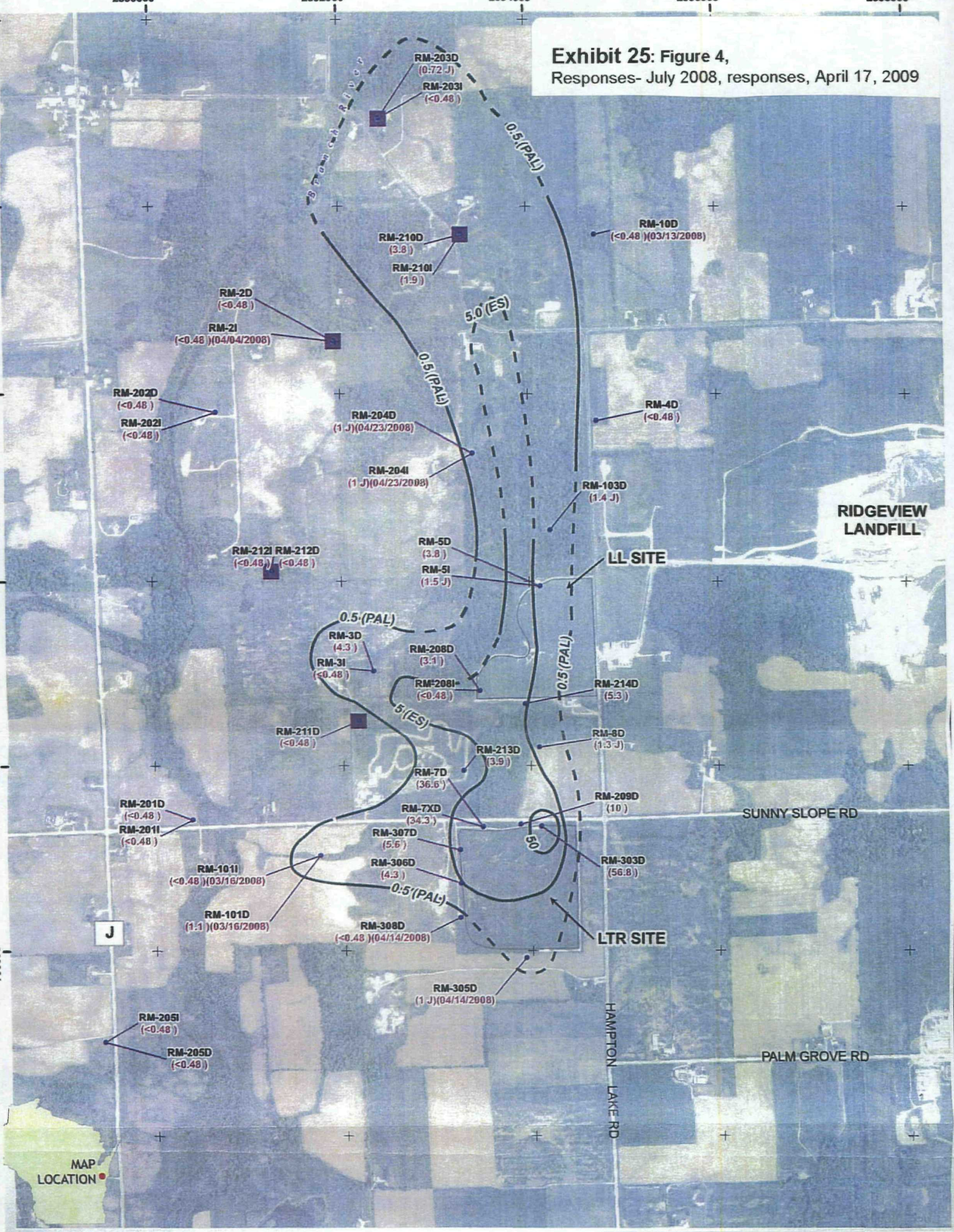
DRAWN BY: MCKEEFRY J	SCALE:	PROJ. NO.	00-03456.44
CHECKED BY: THC	AS NOTED	FILE NO.	34574607.mxd
APPROVED BY: JDW	DATE PRINTED: 12/22/2008	FIGURE 3	
DATE: DECEMBER 2008			

RMT

744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

-6\mxd\34574607.mxd 12/22/2008 11:05:03

Exhibit 25: Figure 4,
Responses- July 2008, responses, April 17, 2009



LEGEND

- MONITORING WELL
- SENTINEL WELLS
- 5 TCE ISO-CONCENTRATION (DASHED WHERE INFERRED)

TCE SAMPLES USED FOR ISO-LINES
LABELS SHOW CONCENTRATION (UG/L) AND SAMPLE DATE IF SAMPLE WAS TAKEN EARLIER THAN JULY 2008

RM-212D
(<0.48)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. J OR Q = RESULT IS BETWEEN THE LOD AND LOQ.
4. TCE WAS NOT DETECTED IN RESIDENTIAL WELL SAMPLES DURING THE REPORTING PERIOD; RESIDENTIAL WELL RESULTS ARE NOT USED FOR CONTOURING.

0 — 1,000 FEET
N
1" = 1,000'
1:12,000

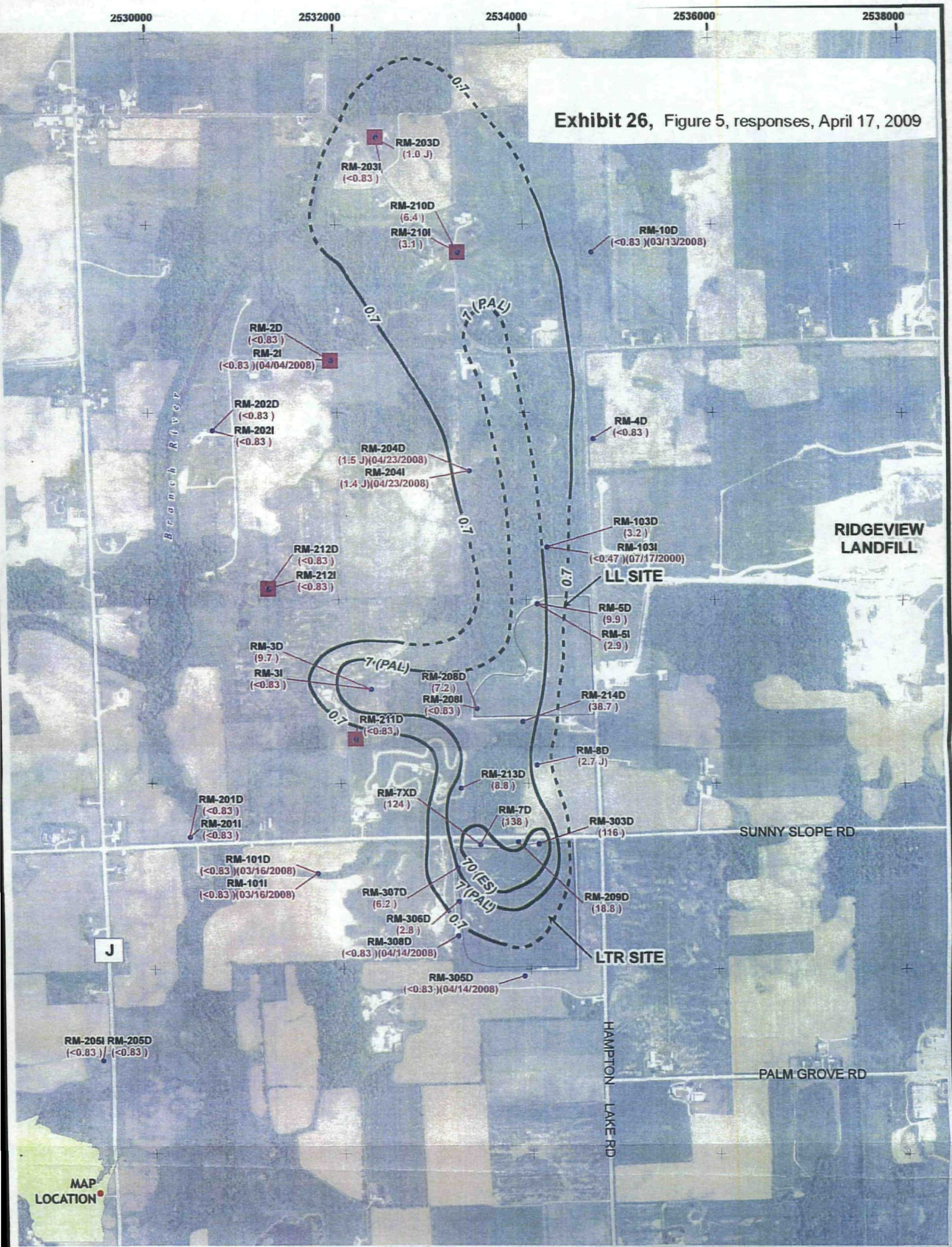
PROJECT:	LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN		
SHEET TITLE:	TCE CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008		
DRAWN BY: MCKEEFRY J	SCALE:	PROJ. NO.	00-03458.40
CHECKED BY: THC	AS NOTED	FILE NO.	34584005.mxd
APPROVED BY: JDW	DATE PRINTED:		
DATE: APRIL 2009	4/10/2009	FIGURE 4	

RMT

744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

13458\40\mxd\34584005.mxd 4/10/2009 14:35:37

Exhibit 26, Figure 5, responses, April 17, 2009



EGEND

- MONITORING WELL (RM)
- SENTINEL WELLS
- CIS-1,2-DCE ISO-CONCENTRATION (DASHED WHERE INFERRED)

S-1,2-DCE SAMPLES USED FOR ISO-LINES
BELS SHOW CONCENTRATION (UG/L) AND
MPLE DATE IF SAMPLE WAS TAKEN EARLIER
IAN JULY 2008

RM-208
(825.53)

LANDFILL AREA

NOTES

1. AERIAL IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM 2005.
2. MAP COORDINATES REFERENCE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FOOT.
3. J OR Q = RESULT IS BETWEEN THE LOD AND LOQ.
4. CIS-1,2-DCE WAS NOT DETECTED IN RESIDENTIAL WELL SAMPLES DURING THE REPORTING PERIOD; RESIDENTIAL WELL RESULTS ARE NOT USED FOR CONTOURING.

N

0 1,000 FEET
1" = 1,000'
1:12,000

PROJECT: LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN

SHEET TITLE: CIS-1,2-DCE CONCENTRATIONS LGU AND BEDROCK UNIT-JULY 2008

DRAWN BY:	MCKEEFRY J	SCALE:		PROJ. NO.	00-03458.40
CHECKED BY:	THC	AS NOTED		FILE NO.	34584007.mxd
APPROVED BY:	JDW	DATE PRINTED:		FIGURE 5	
DATE:	APRIL 2009	4/10/2009			

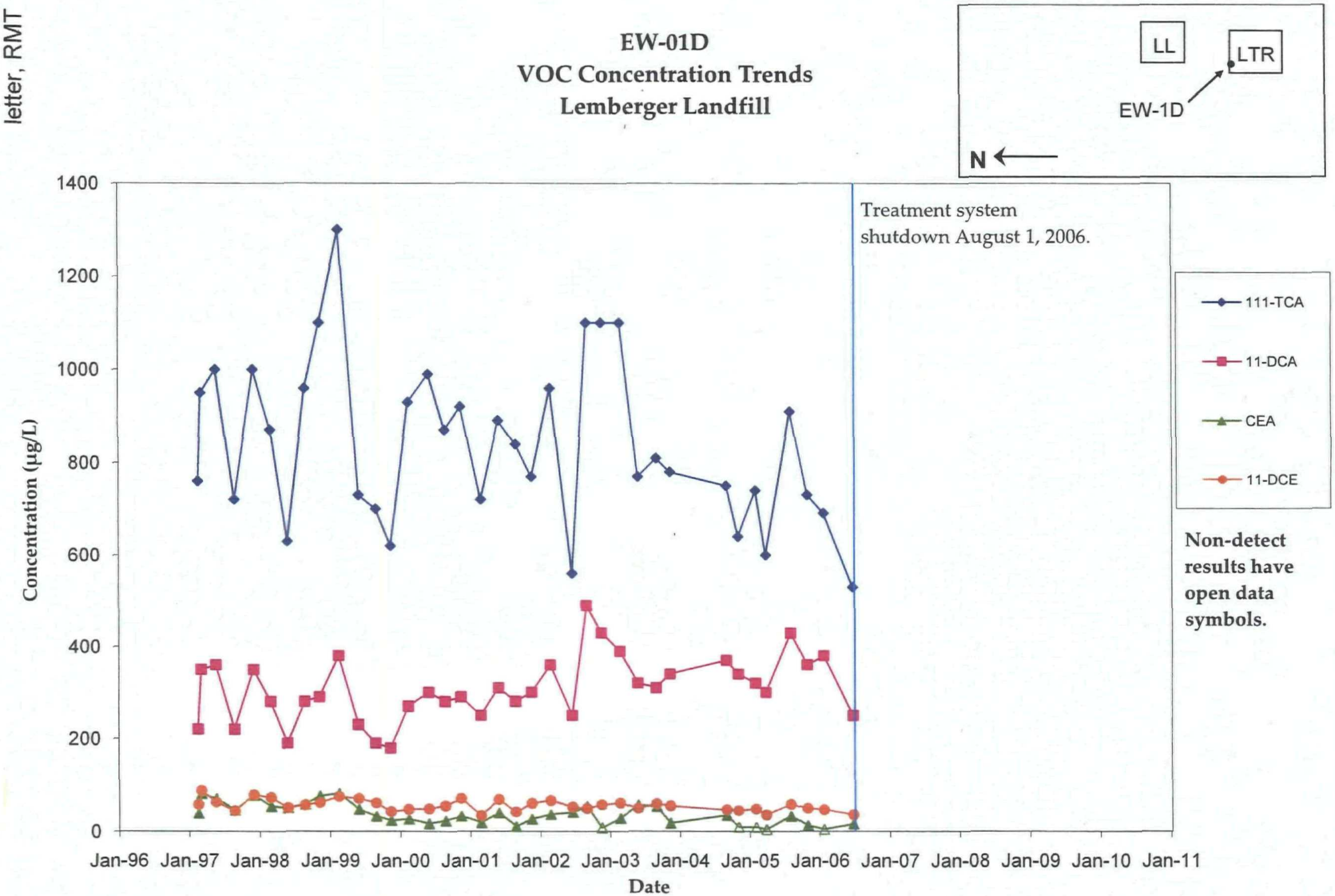
RMT

744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

8\40\mxd\34584007.mxd 4/10/2009 15:35:54

Page 1 of 108
Exhibit 27
April 23, 2010,
letter, RMT

EW-01D
VOC Concentration Trends
Lemberger Landfill



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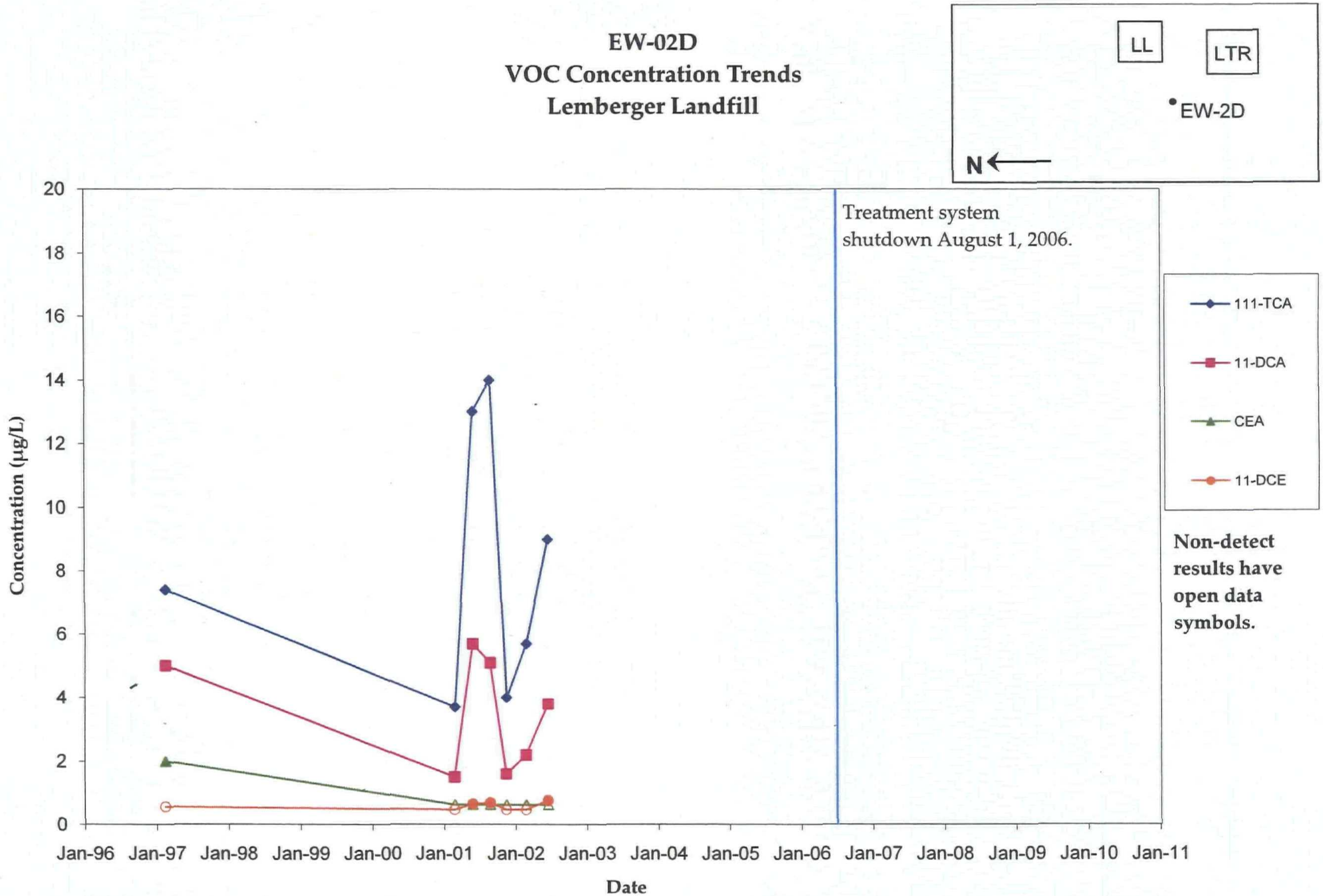
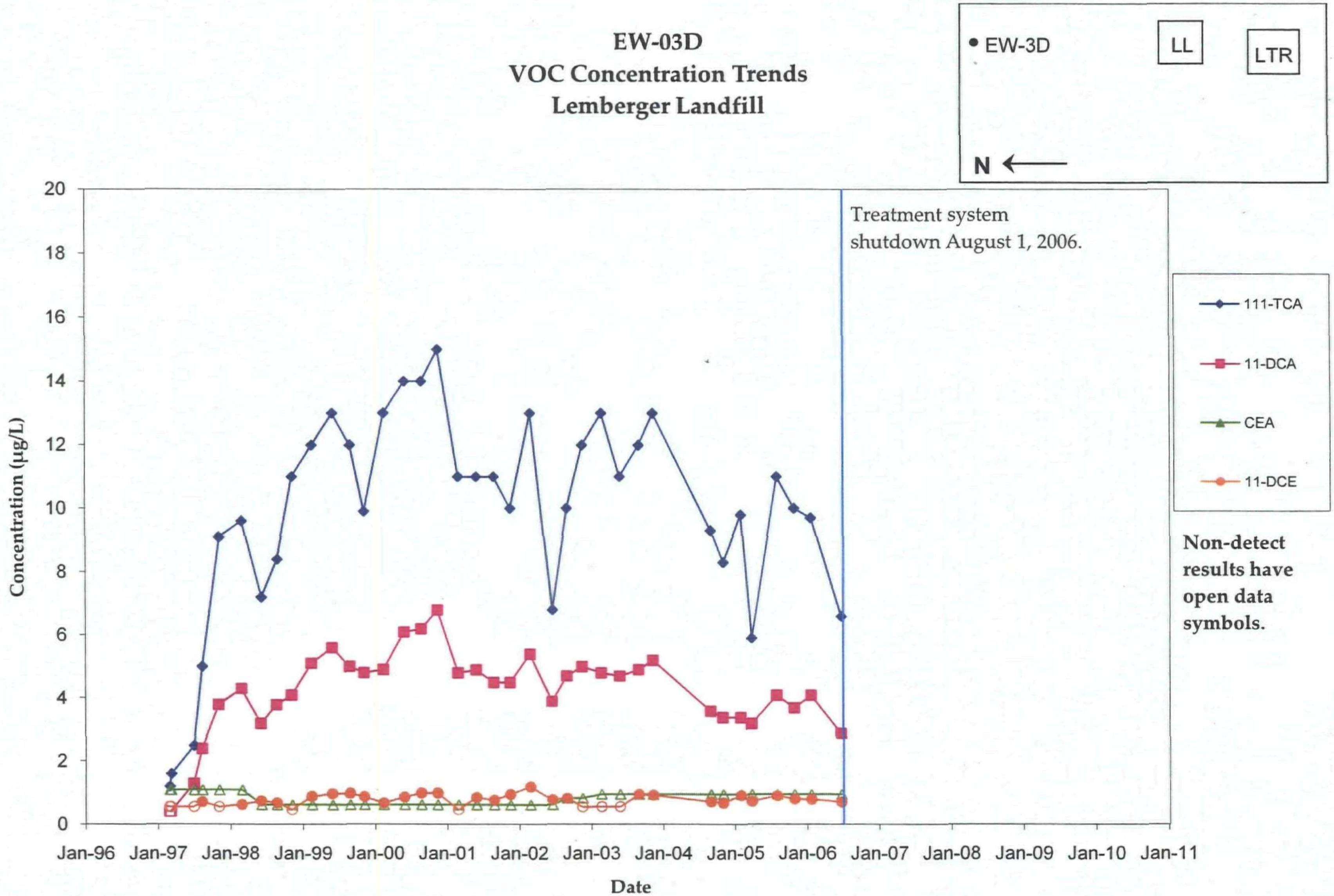
EW-02D
VOC Concentration Trends
Lemberger Landfill



EW-03D
VOC Concentration Trends
Lemberger Landfill



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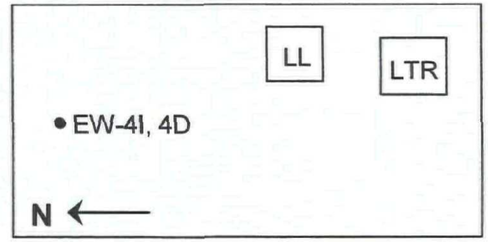
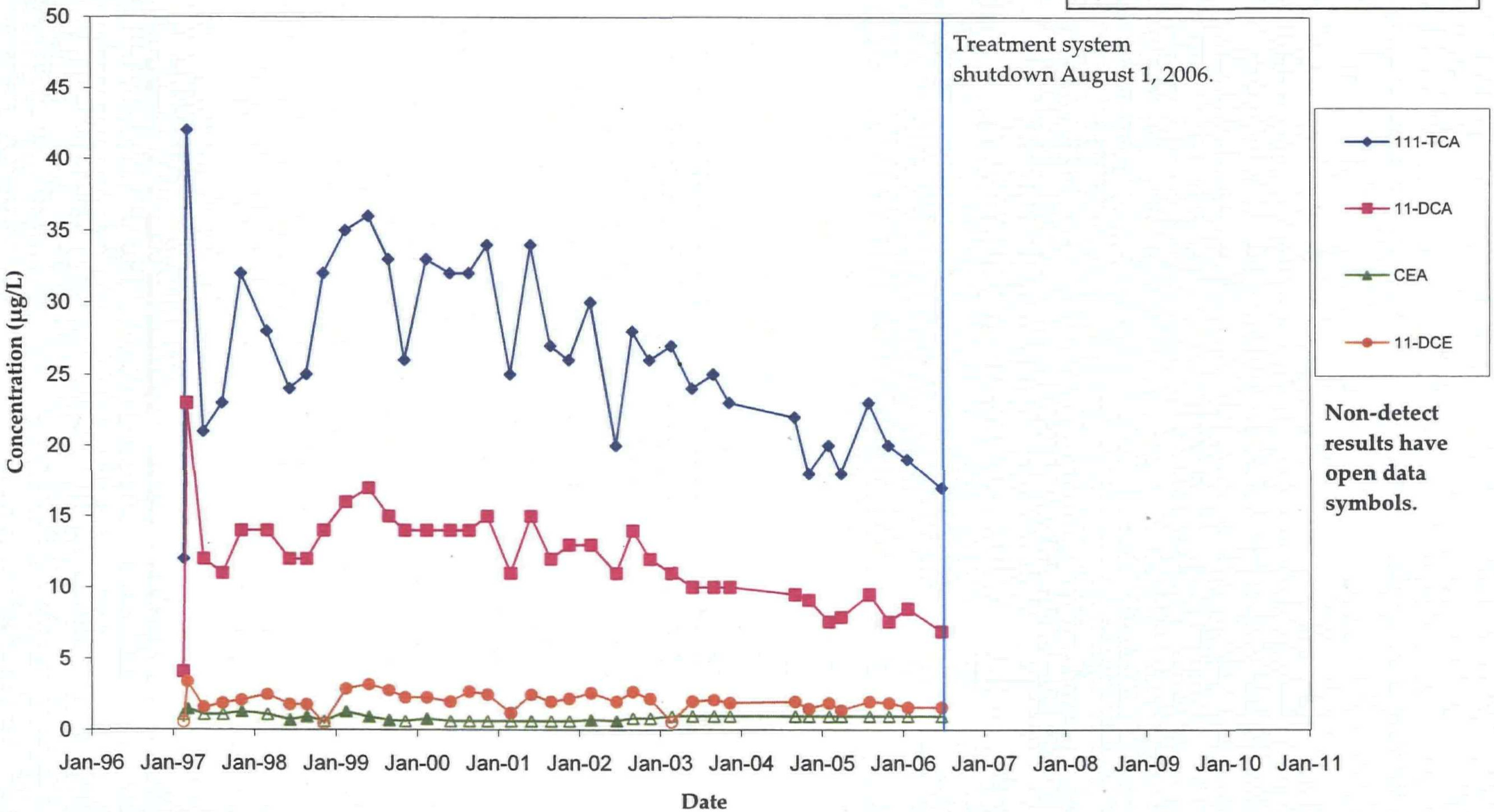
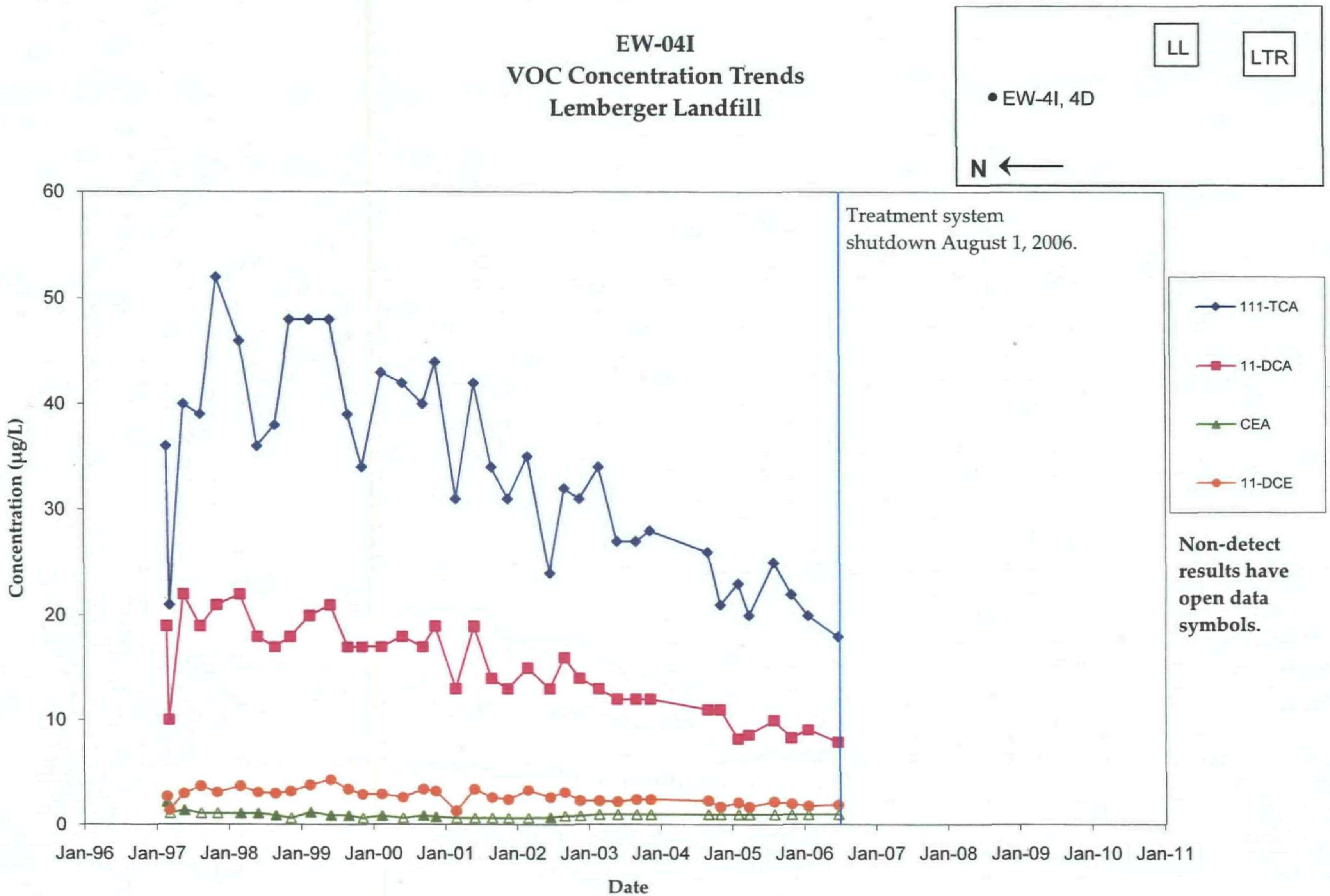
EW-04D
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.



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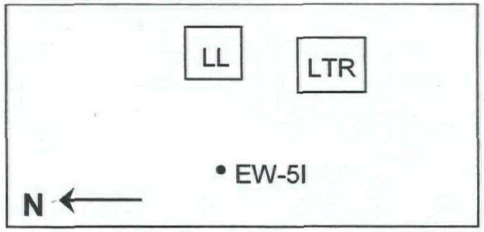
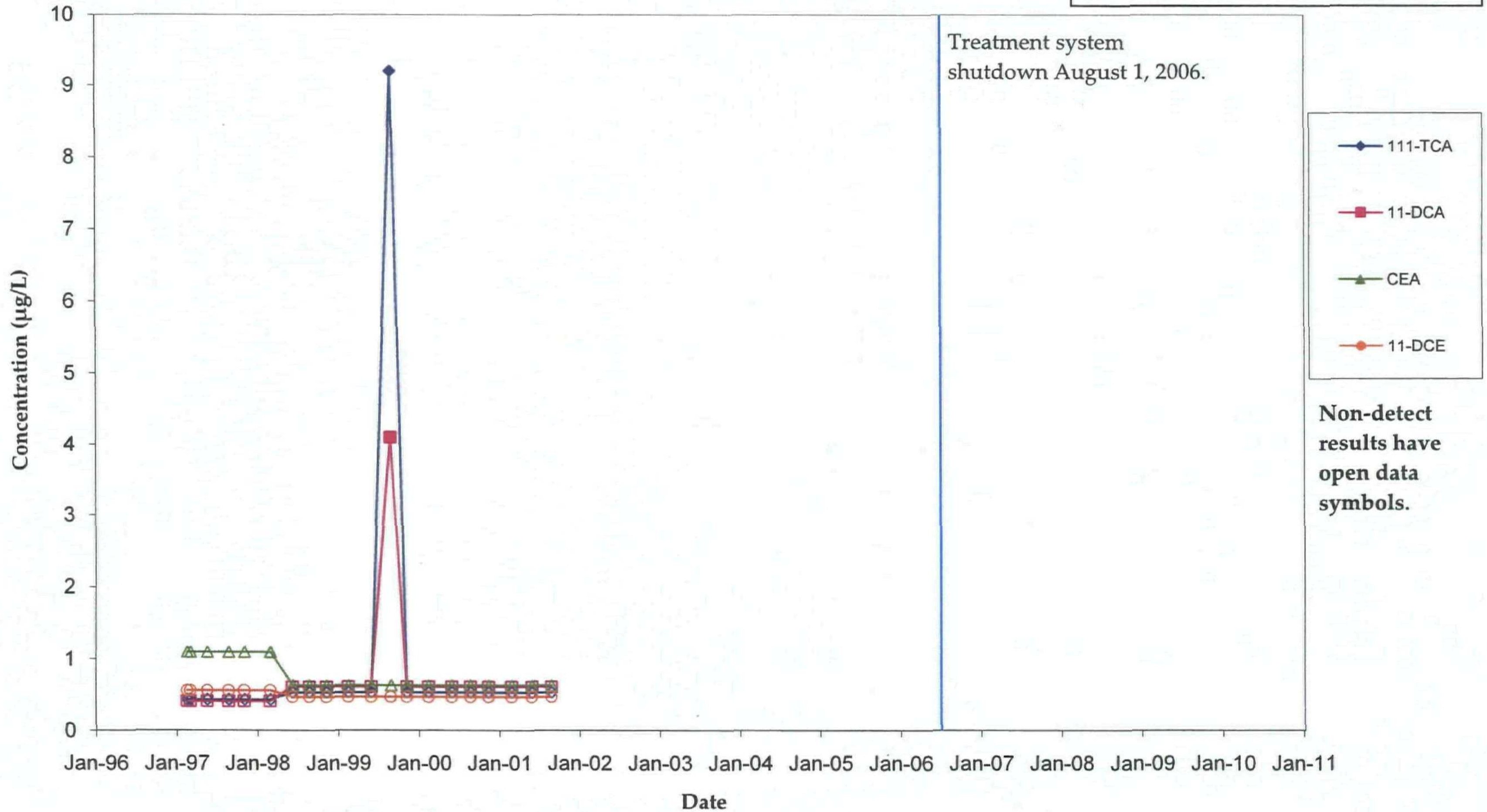
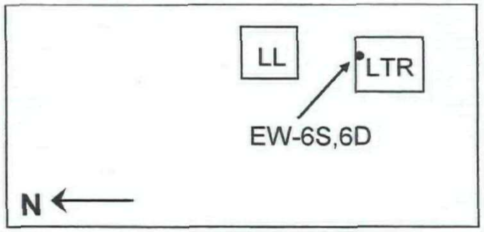
EW-05I
VOC Concentration Trends
Lemberger Landfill

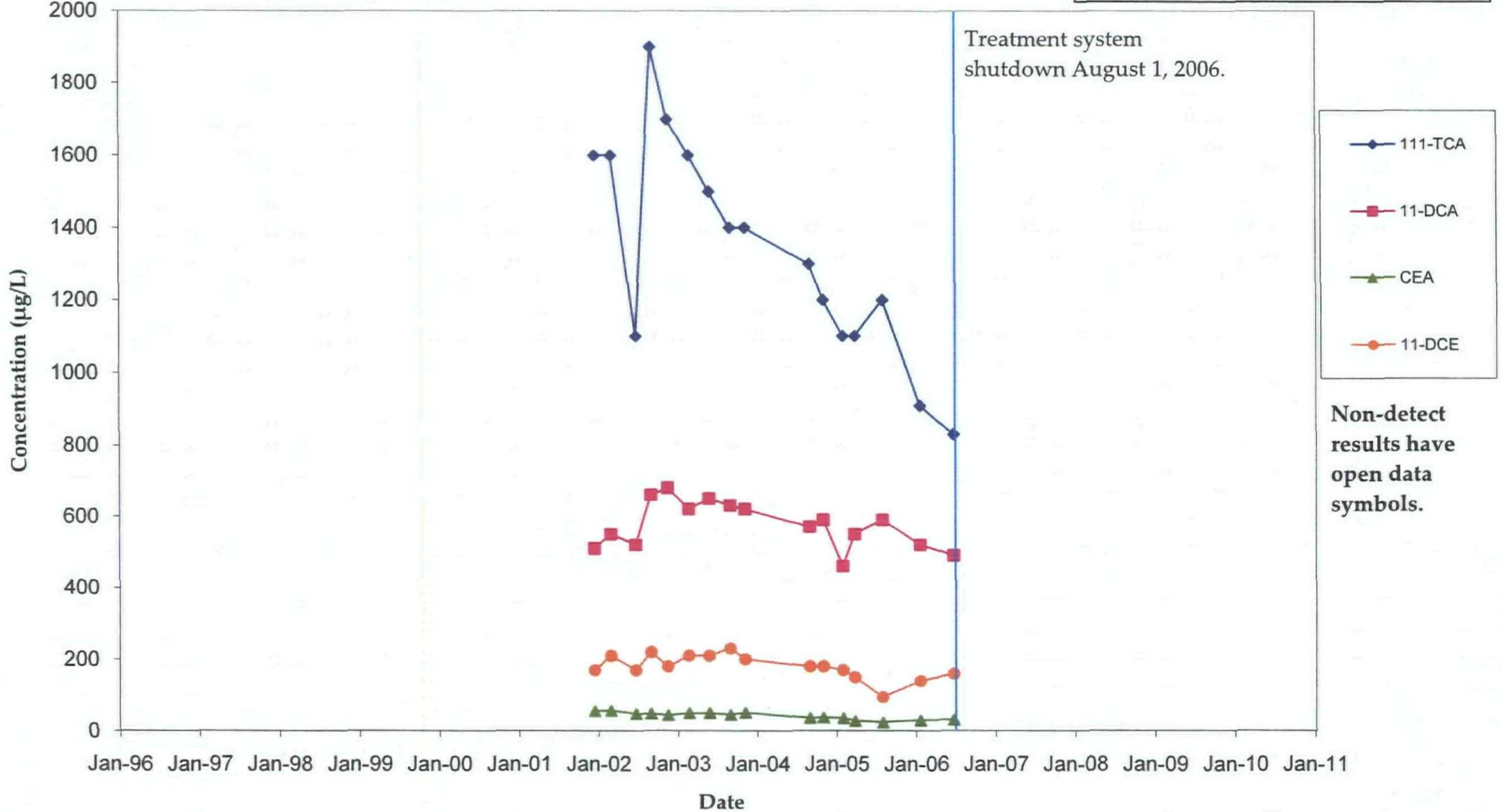




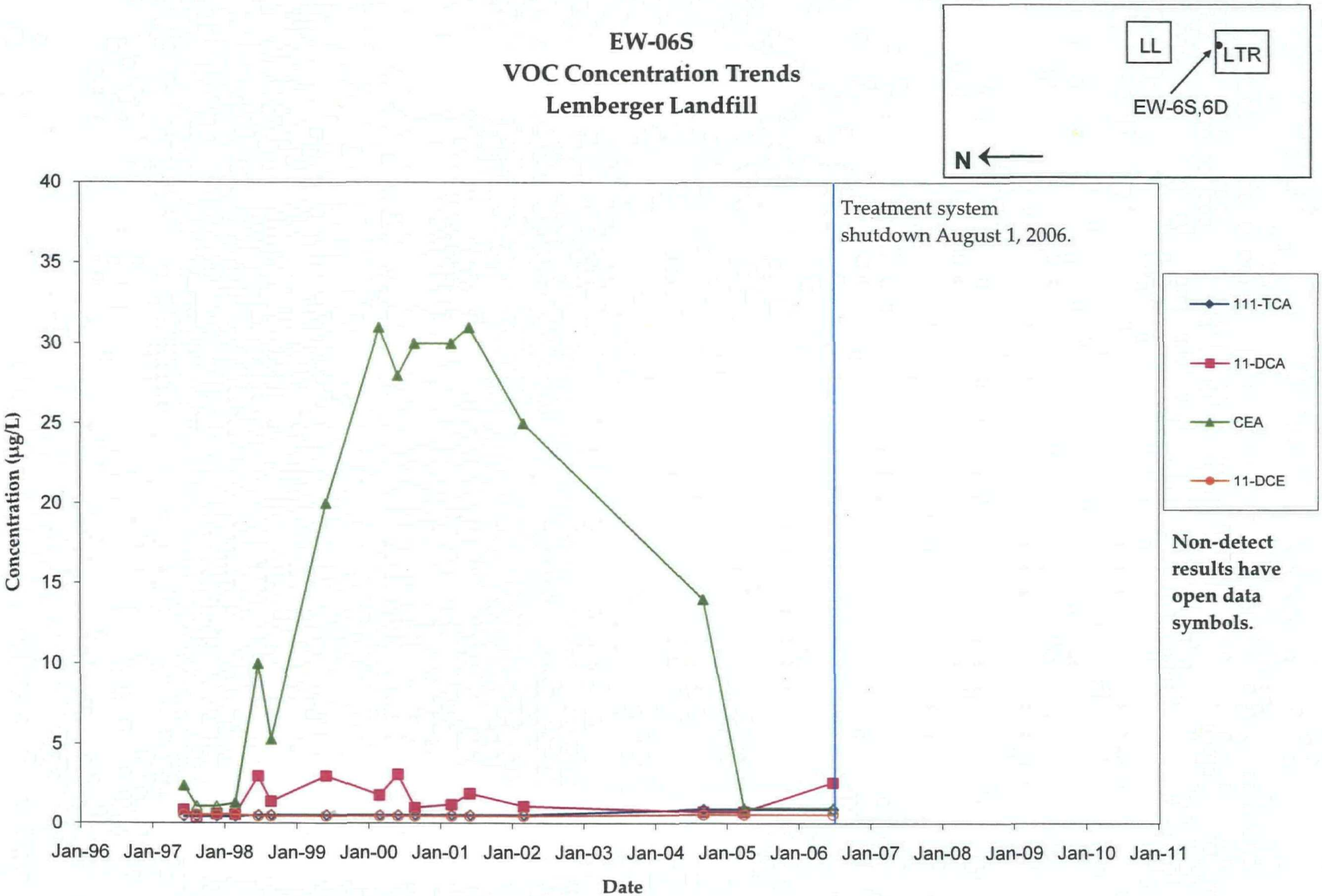
Non-detect results have open data symbols.

EW-06D
VOC Concentration Trends
Lemberger Landfill





EW-06S
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.

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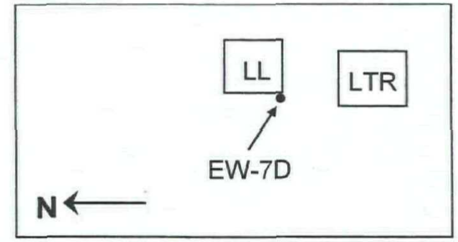
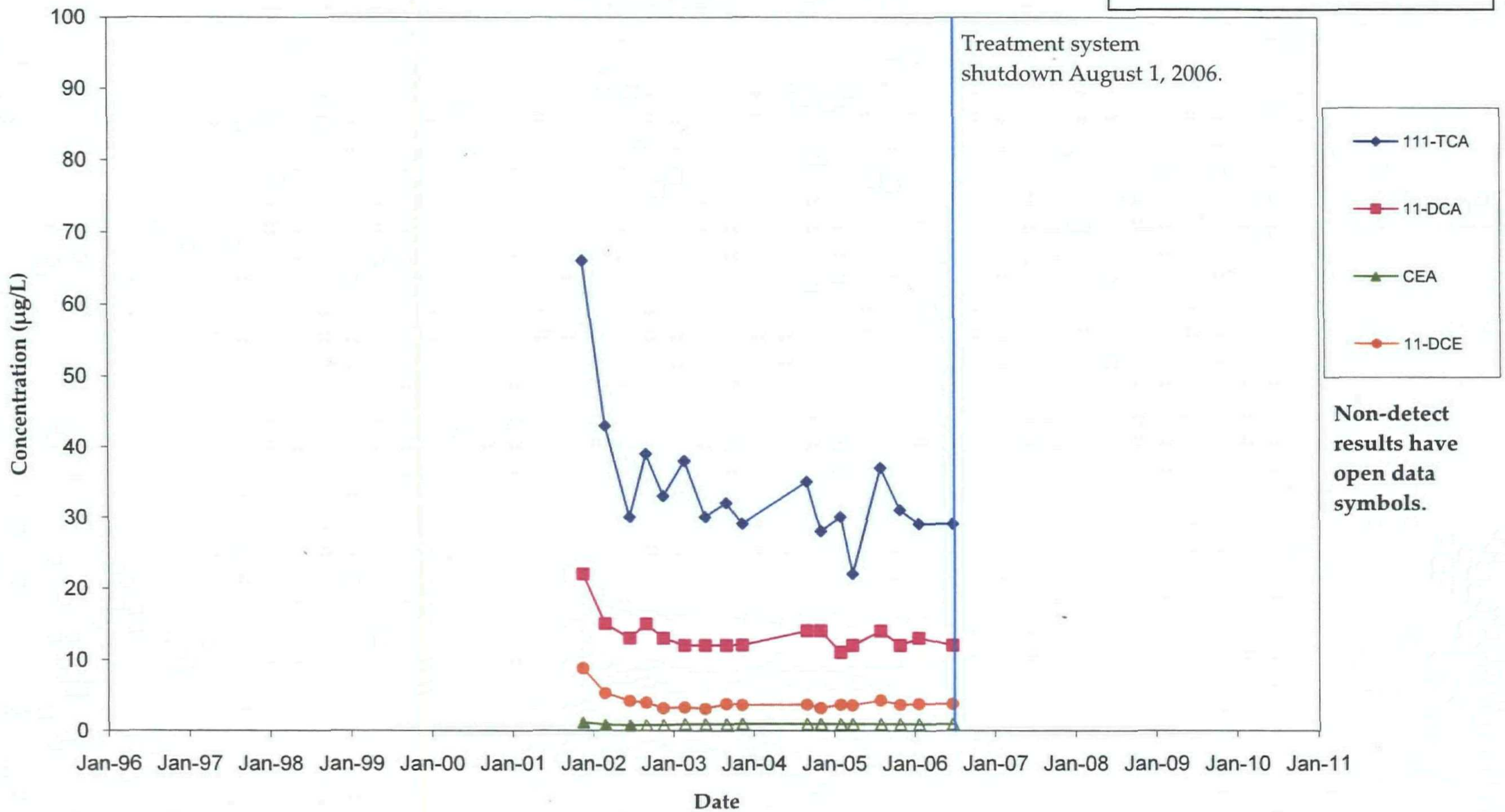
EW-07D
VOC Concentration Trends
Lemberger Landfill





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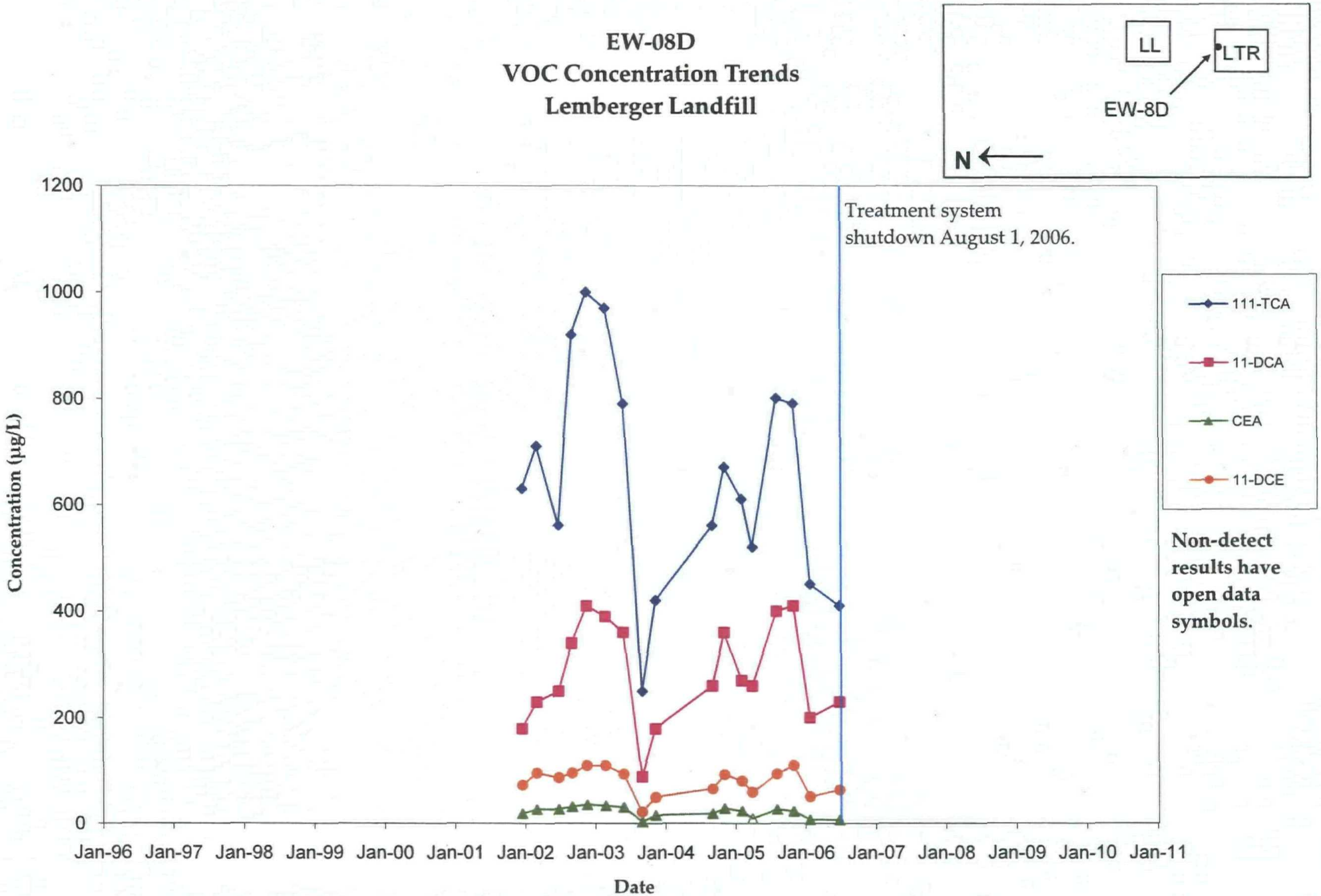
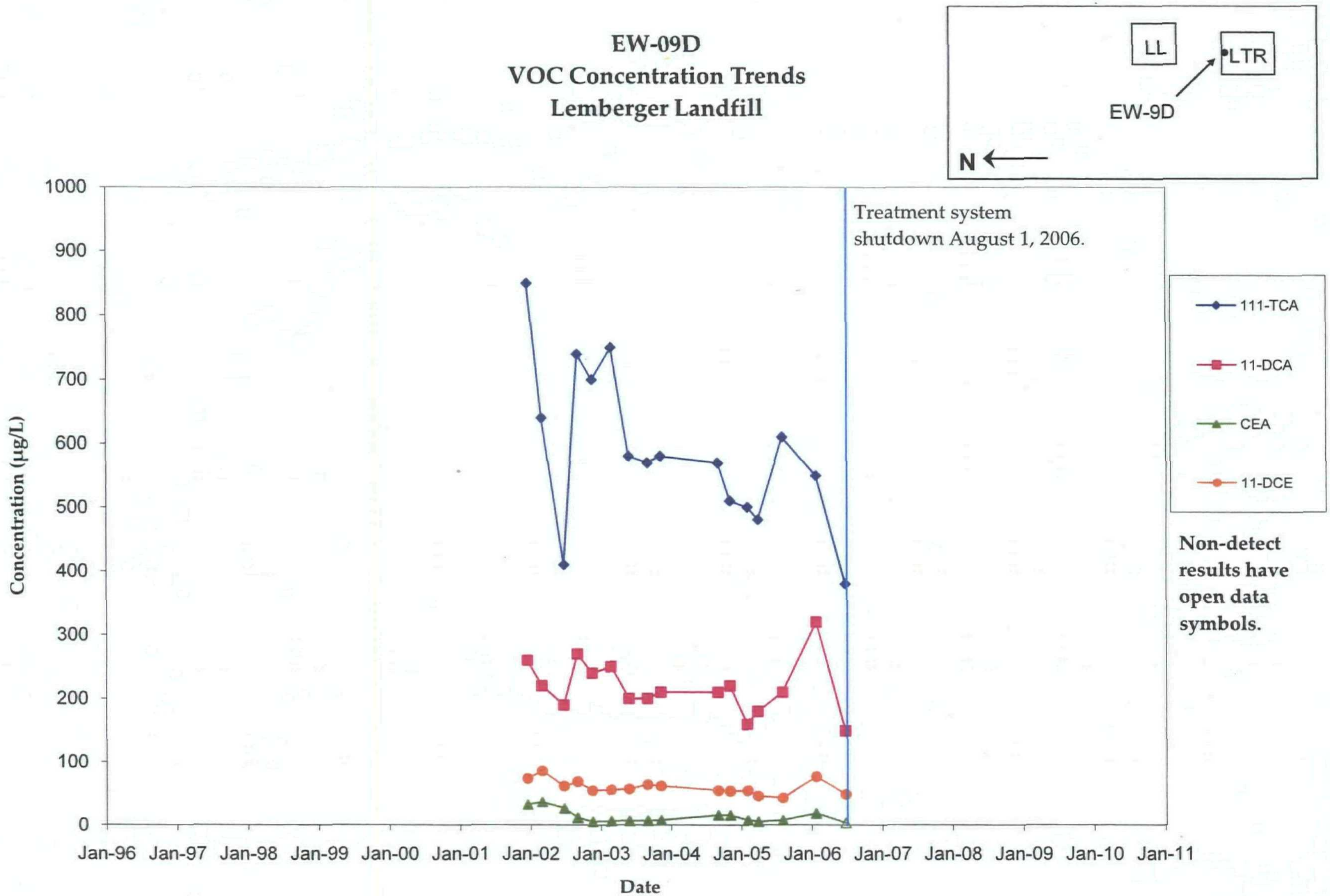
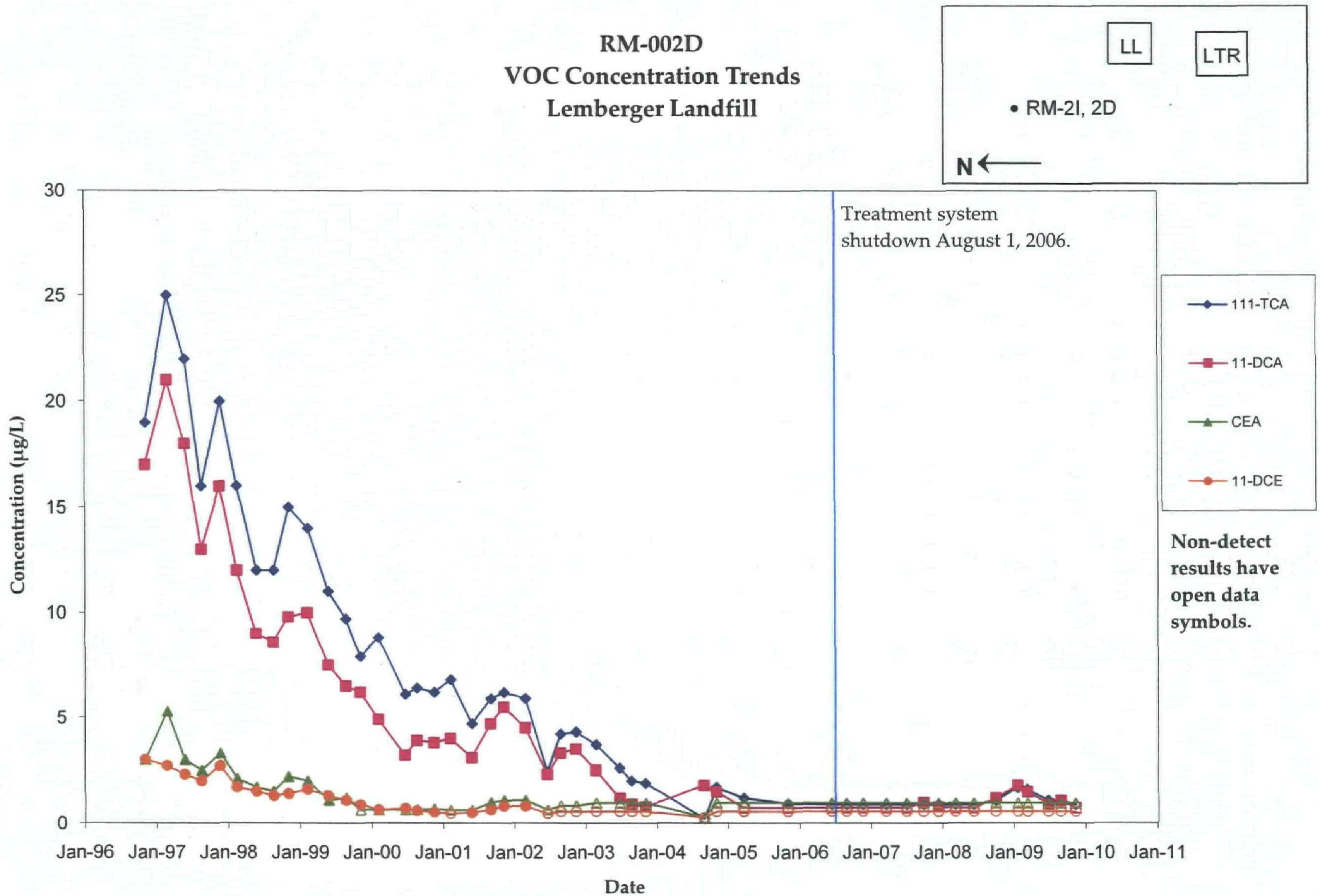
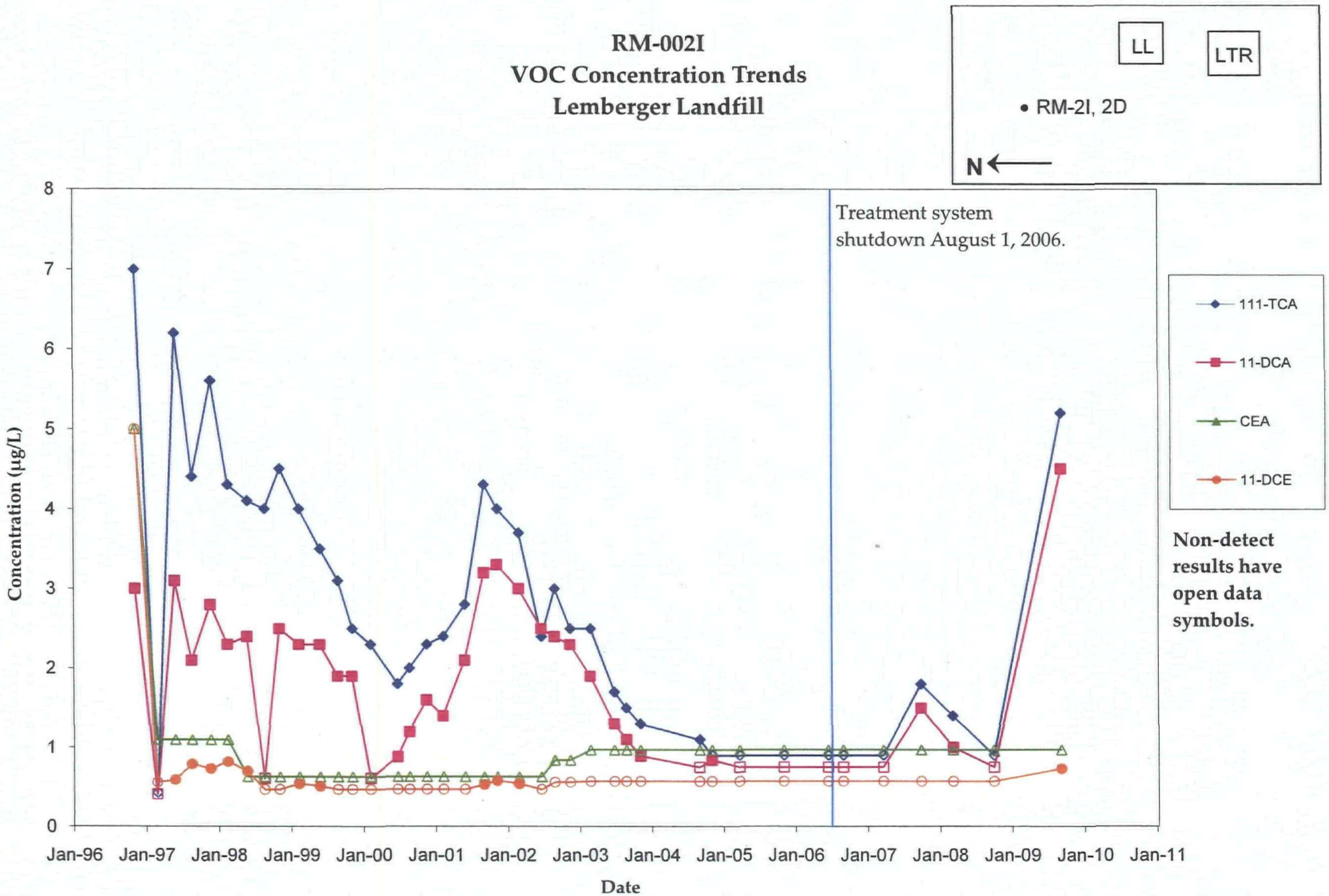

EW-08D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
EW-8D
N
1200
1000
800
600
400
200
0
Concentration (µg/L)
Treatment system shutdown August 1, 2006.
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.


EW-09D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
EW-9D
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
1000
900
800
700
600
500
400
300
200
100
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date

RM-002D
VOC Concentration Trends
Lemberger Landfill





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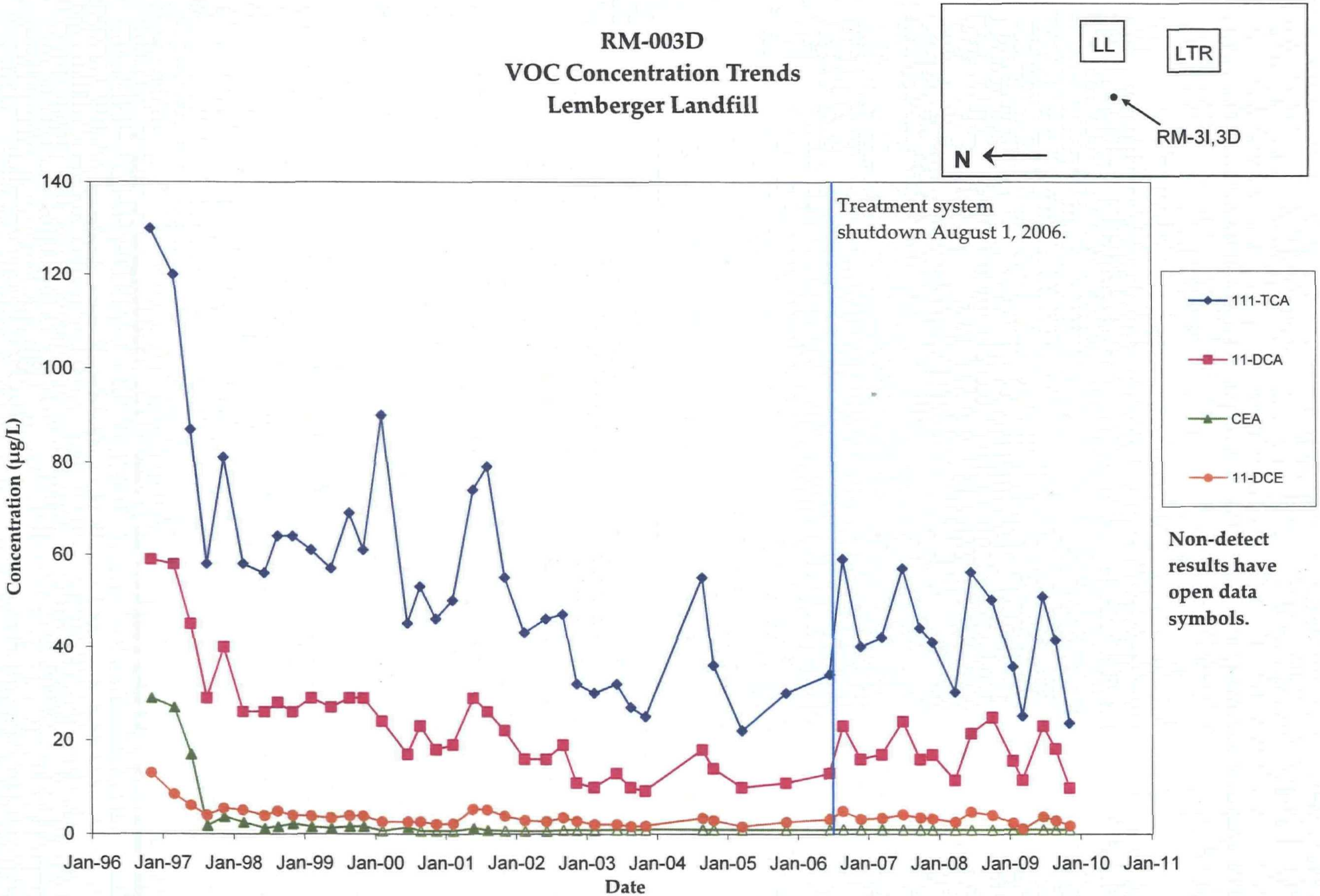
RM-003D
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.

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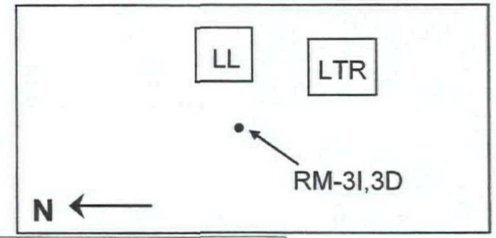
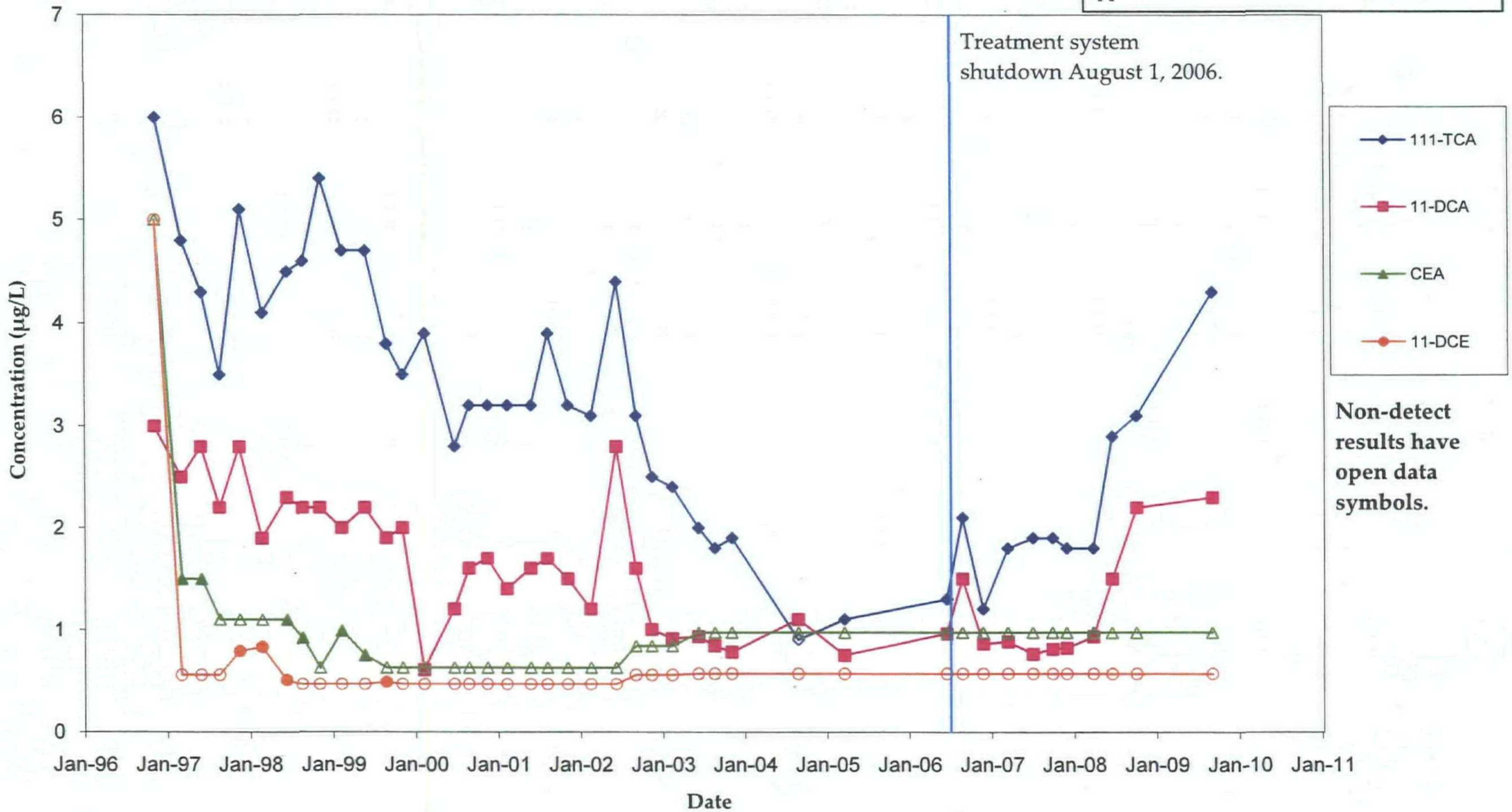
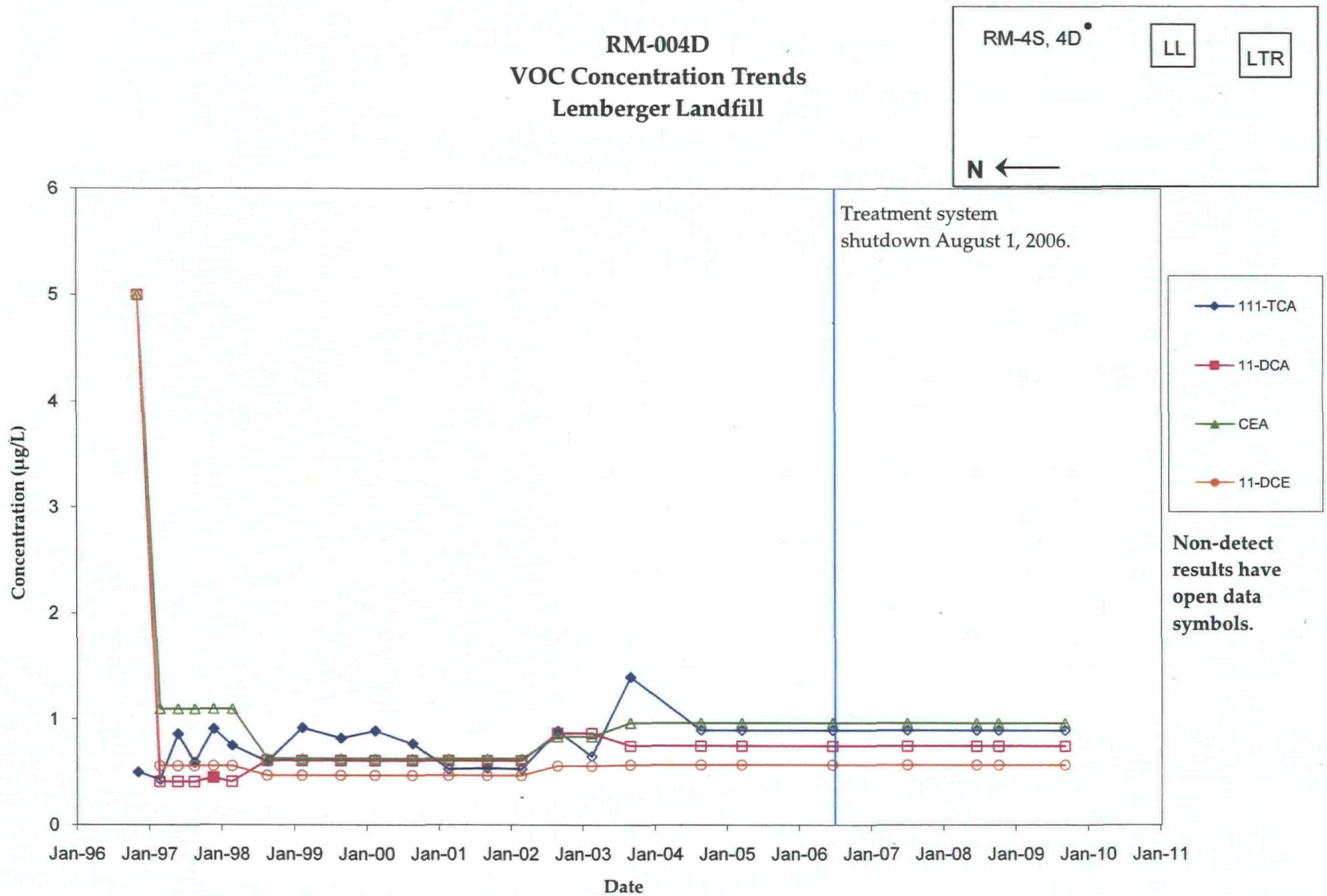
RM-003I
VOC Concentration Trends
Lemberger Landfill

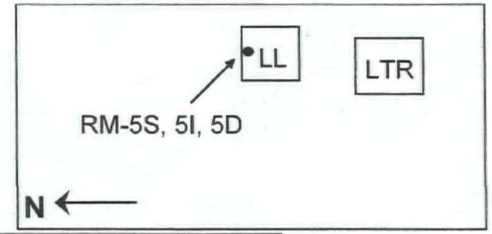


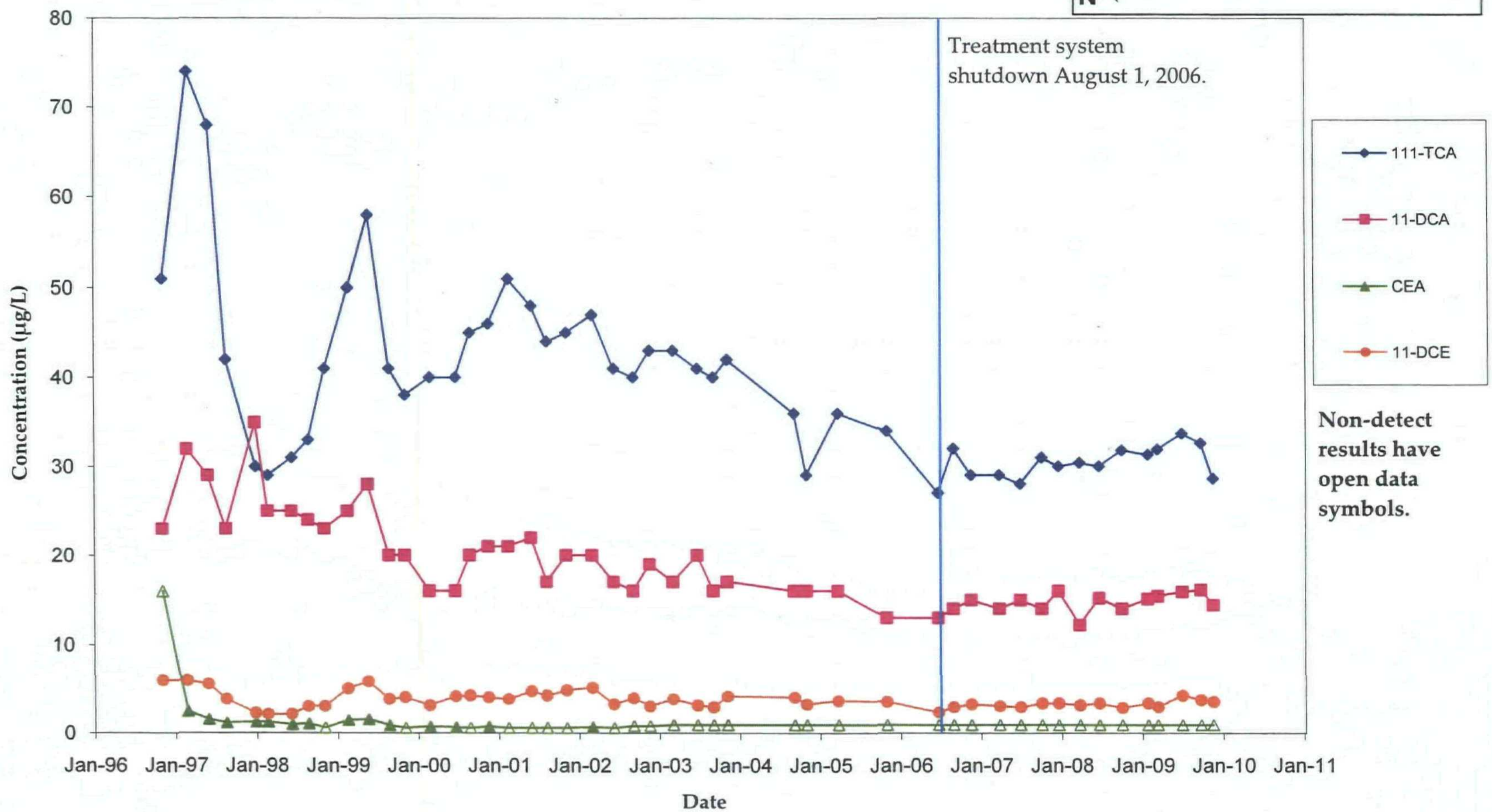


Non-detect results have open data symbols.


RM-004D
VOC Concentration Trends
Lemberger Landfill
RM-4S, 4D
LL
LTR
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
0
1
2
3
4
5
6
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date

RM-005D
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

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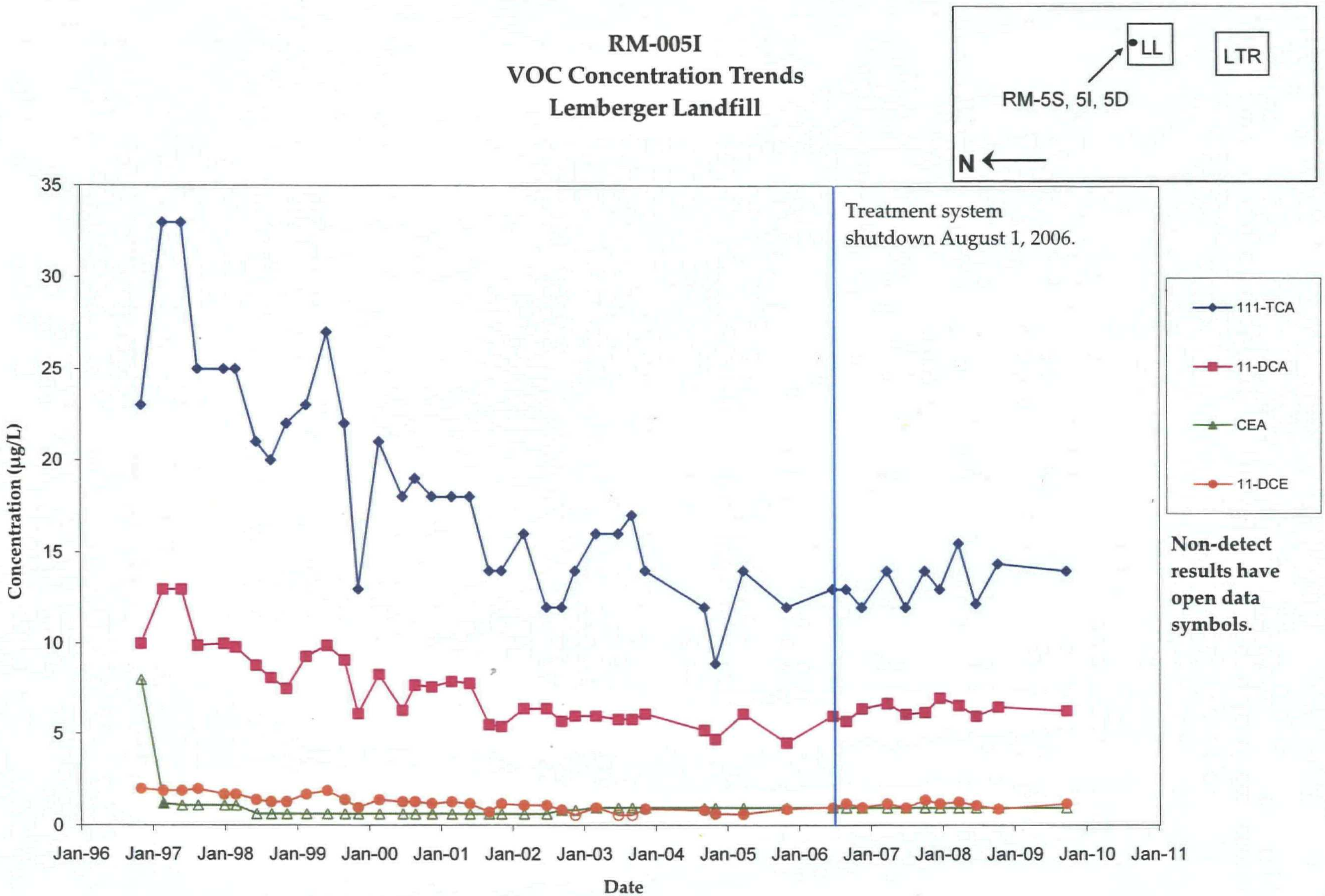
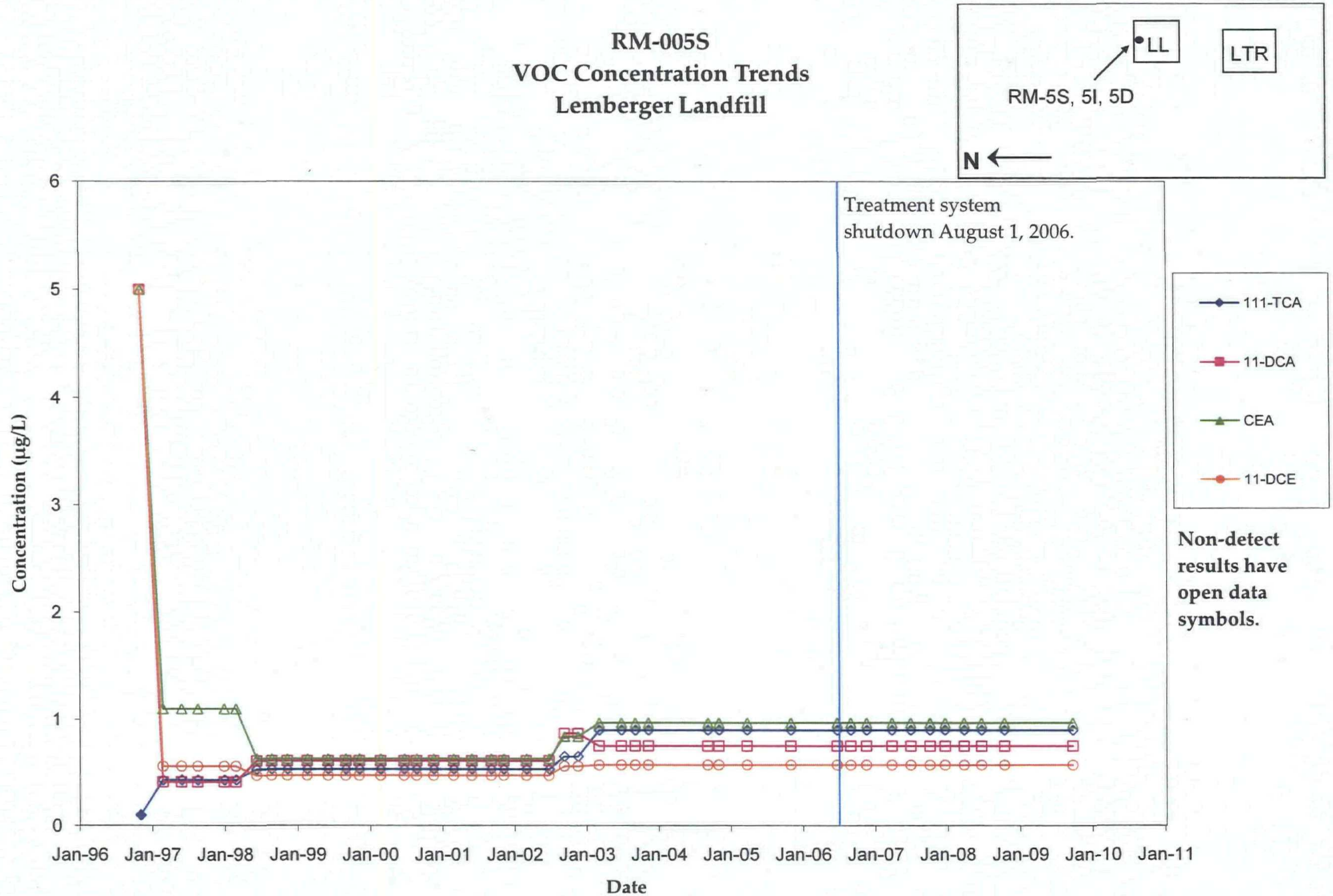
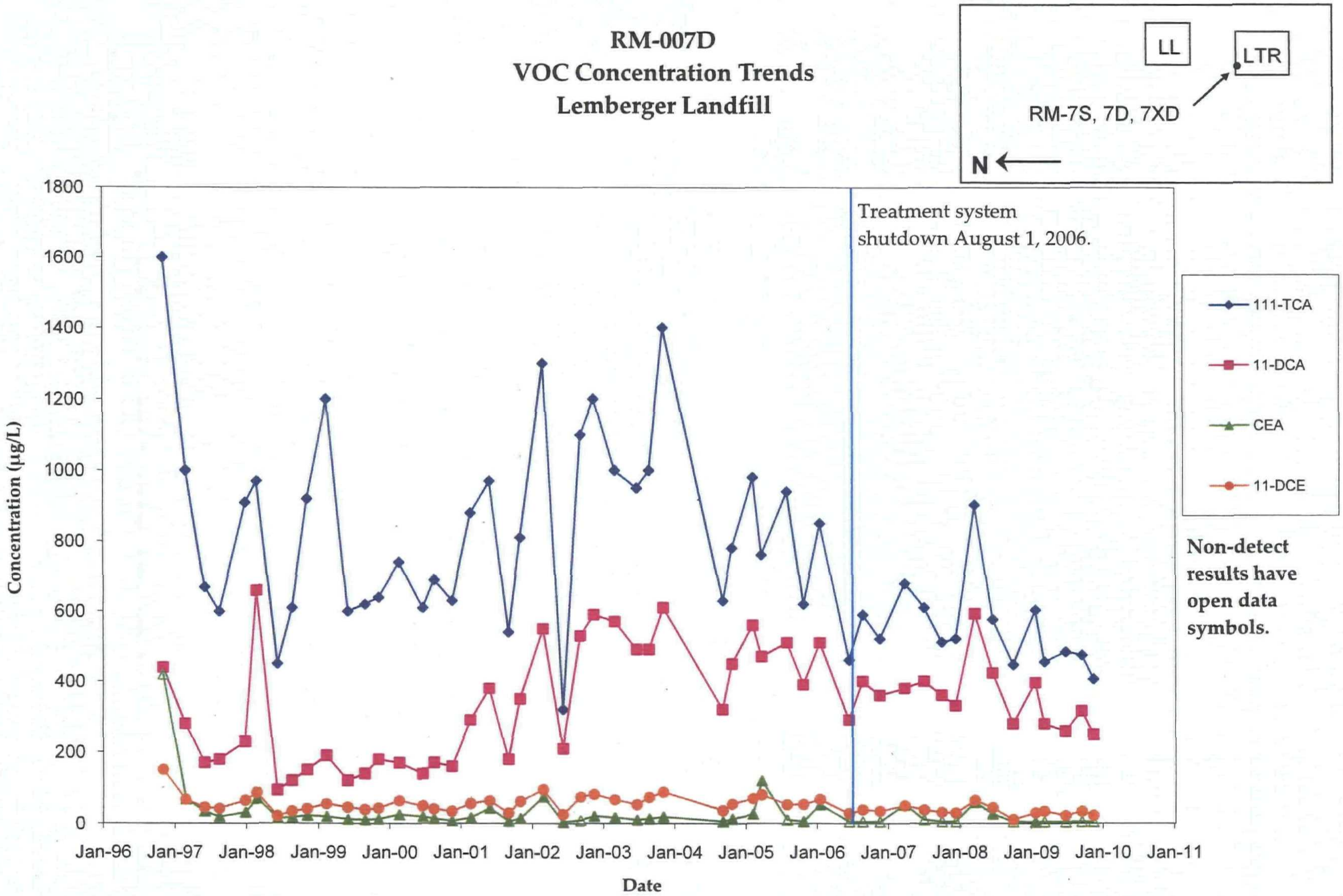
RM-005I
VOC Concentration Trends
Lemberger Landfill



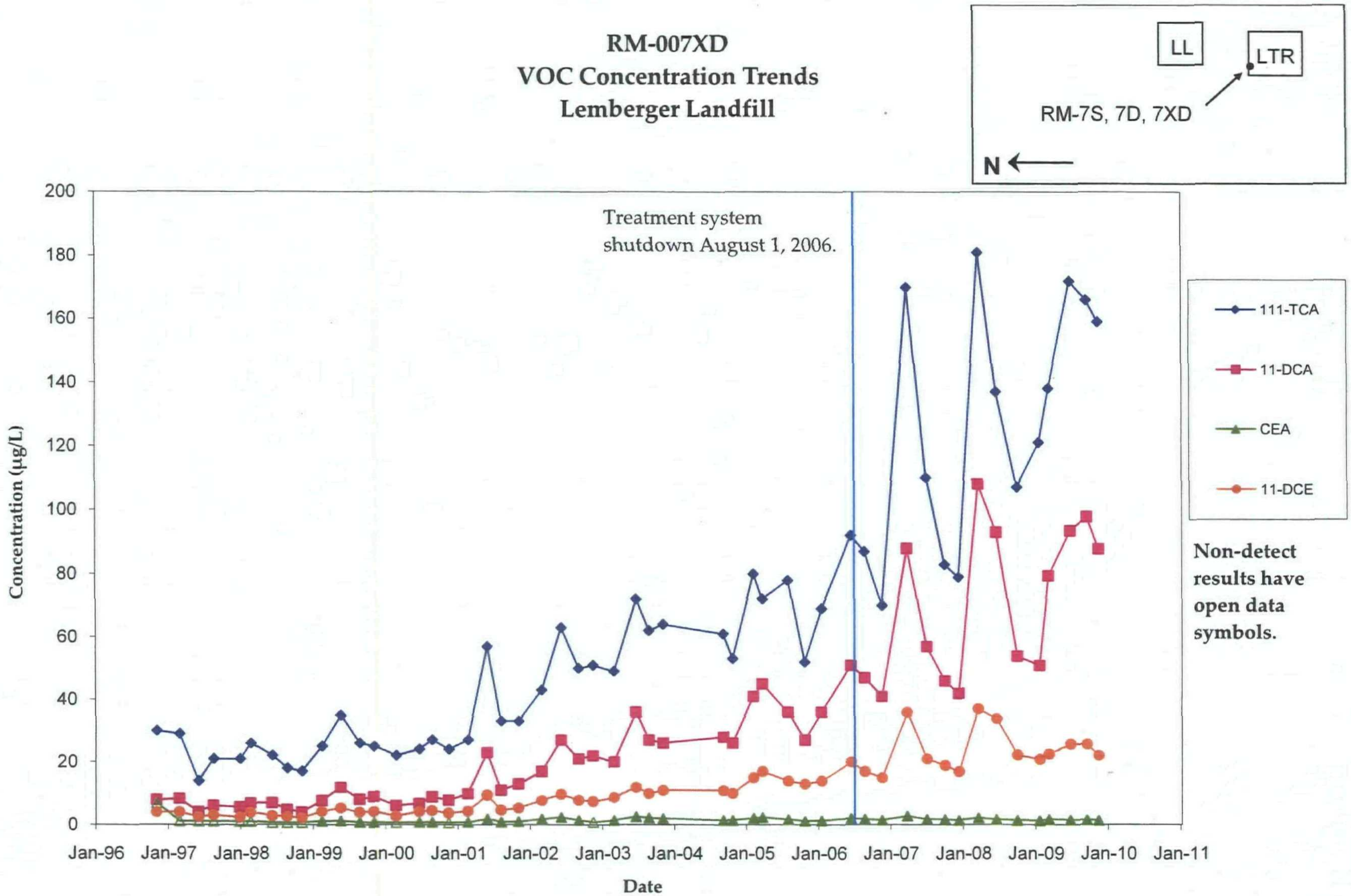
RM-005S
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.

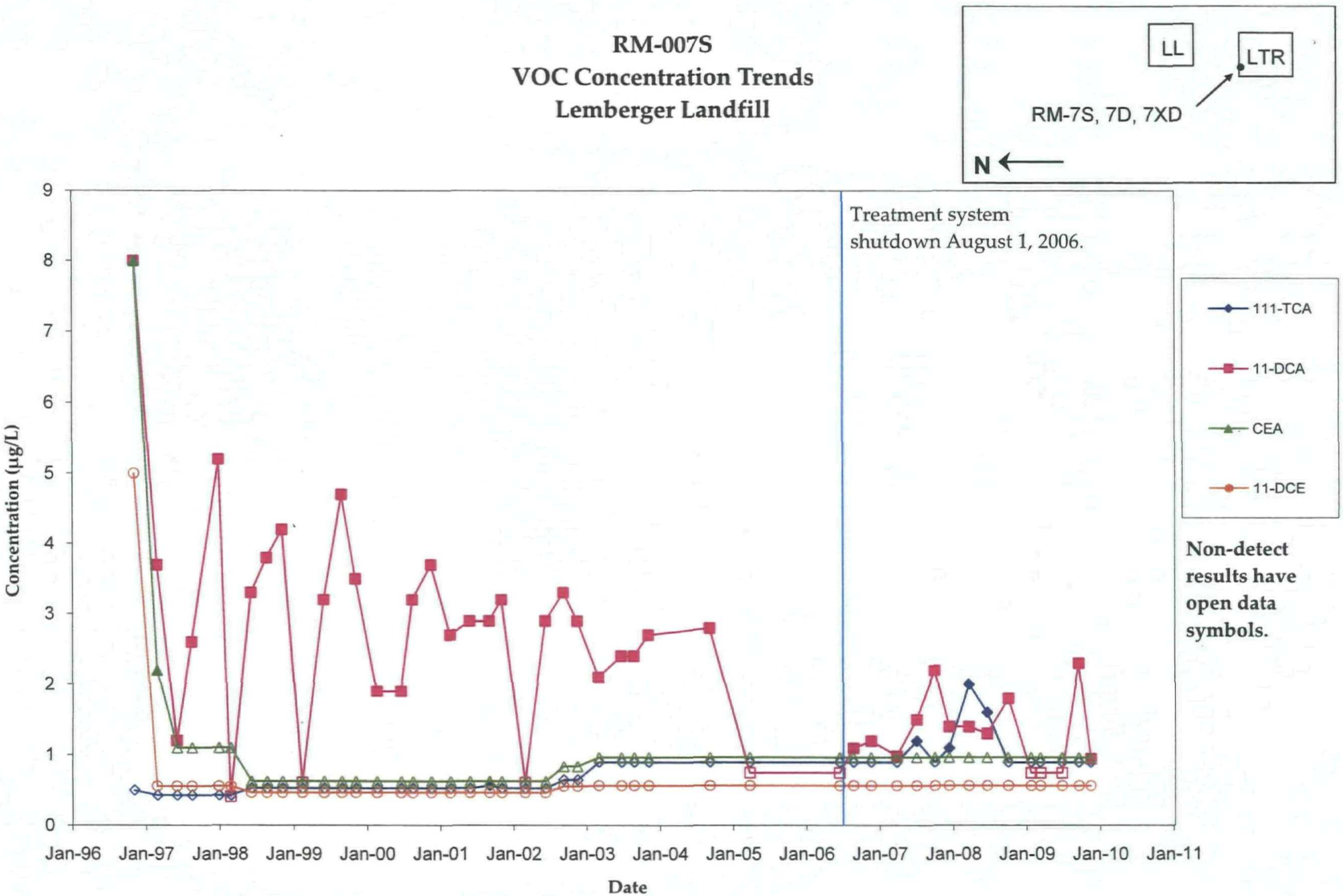

RM-007D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-7S, 7D, 7XD
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
Jan-96 Jan-97 Jan-98 Jan-99 Jan-00 Jan-01 Jan-02 Jan-03 Jan-04 Jan-05 Jan-06 Jan-07 Jan-08 Jan-09 Jan-10 Jan-11
Date

RM-007XD
VOC Concentration Trends
Lemberger Landfill



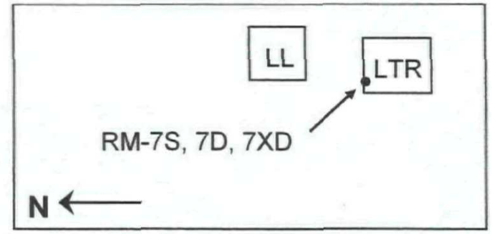
Non-detect results have open data symbols.

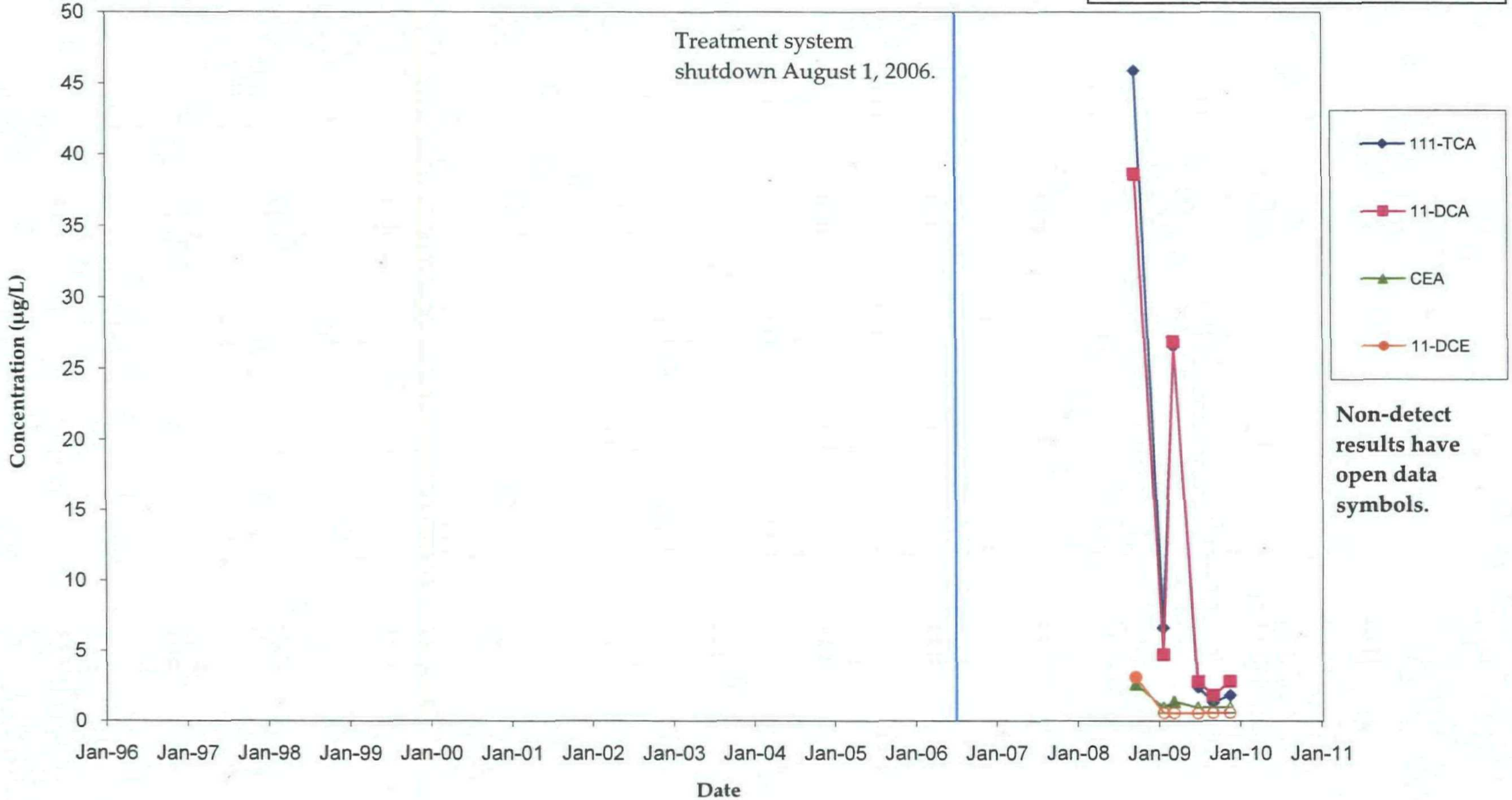
RM-007S
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.

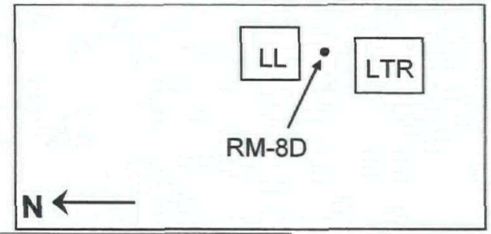
RM-007XXD
VOC Concentration Trends
Lemberger Landfill

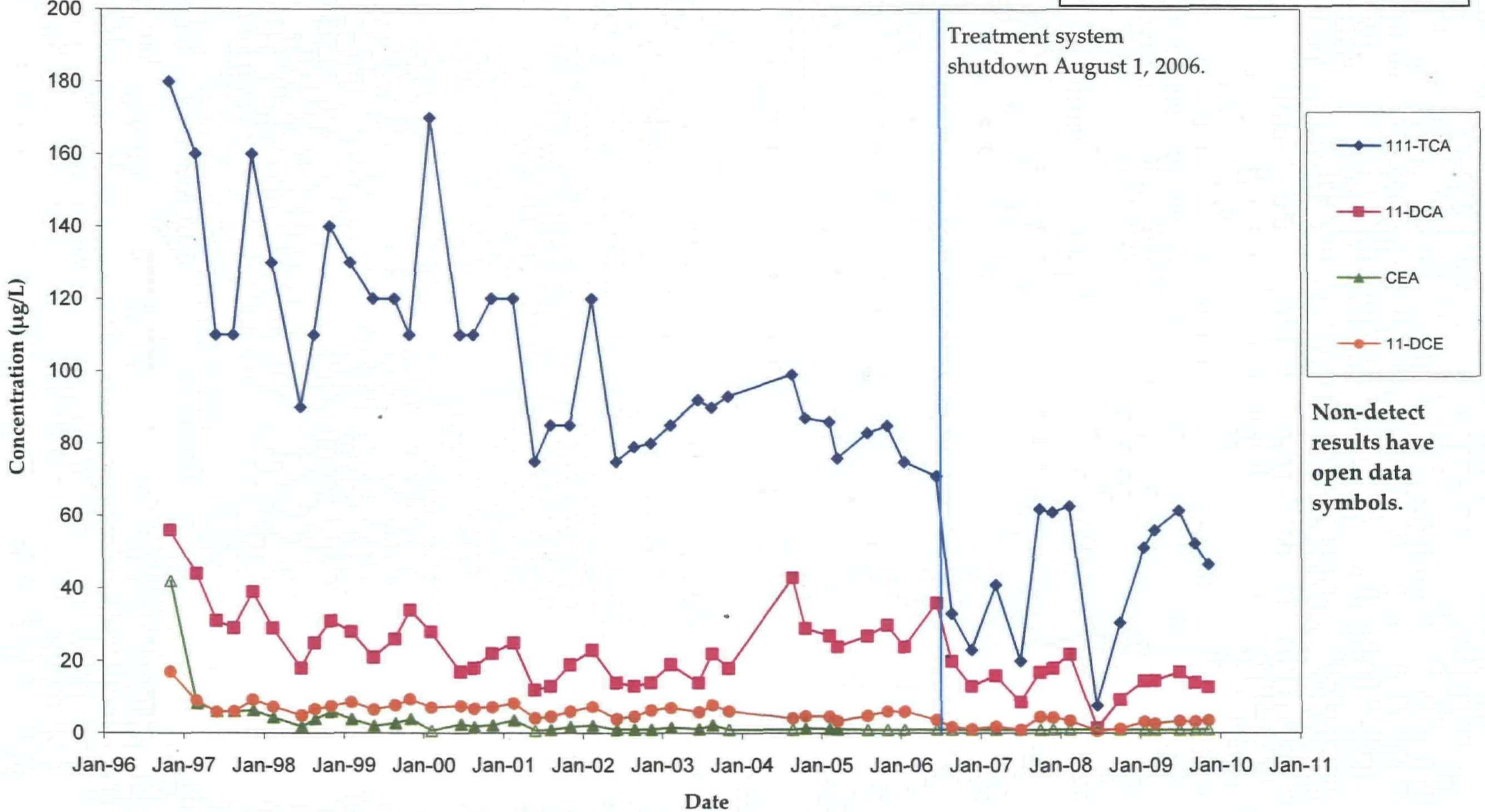


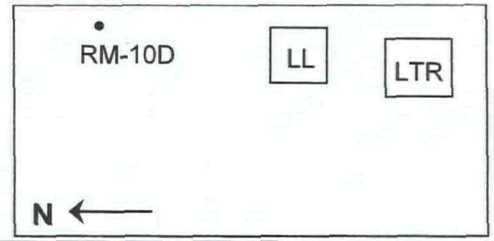


Non-detect results have open data symbols.

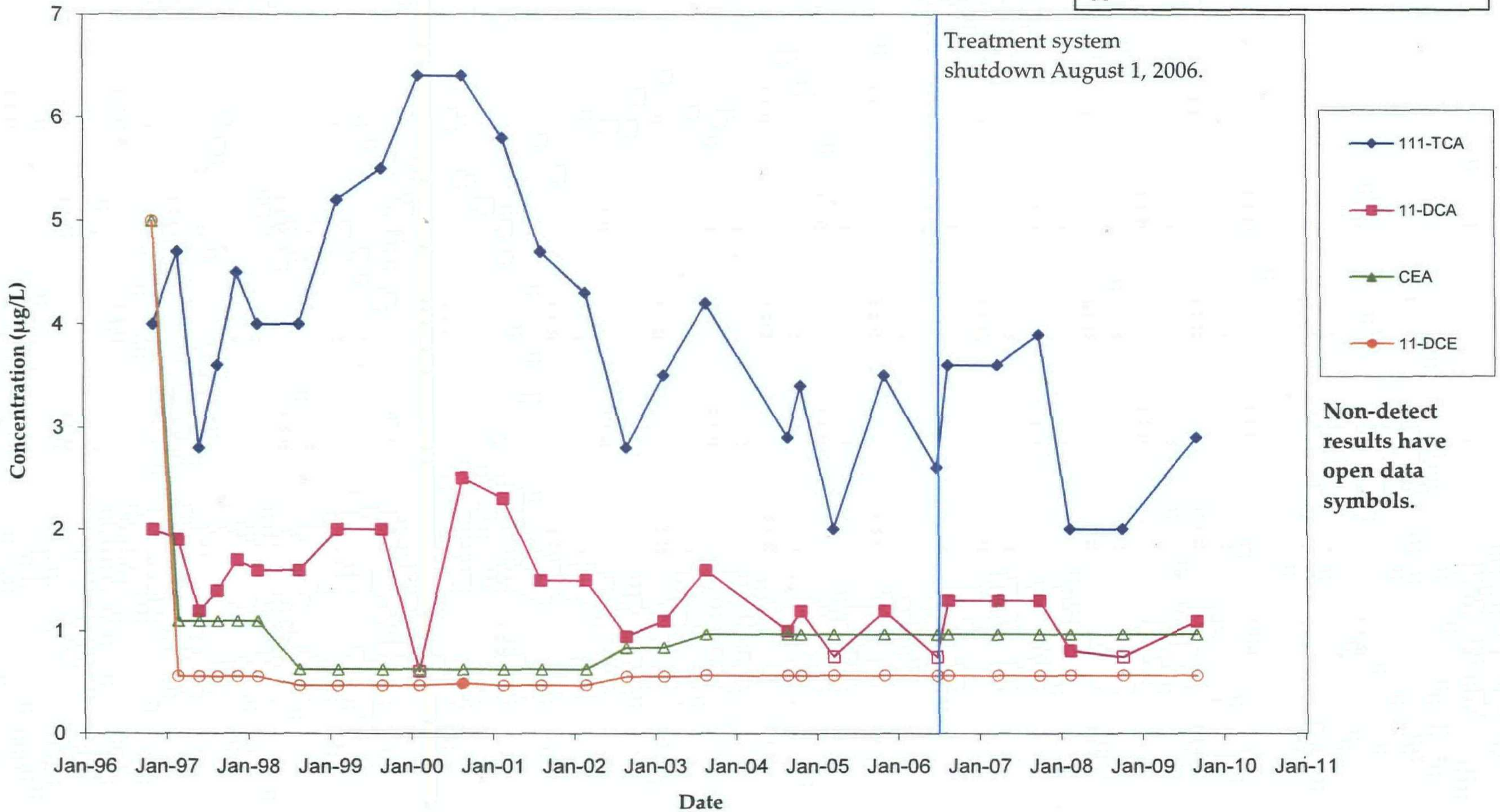
RM-008D
VOC Concentration Trends
Lemberger Landfill



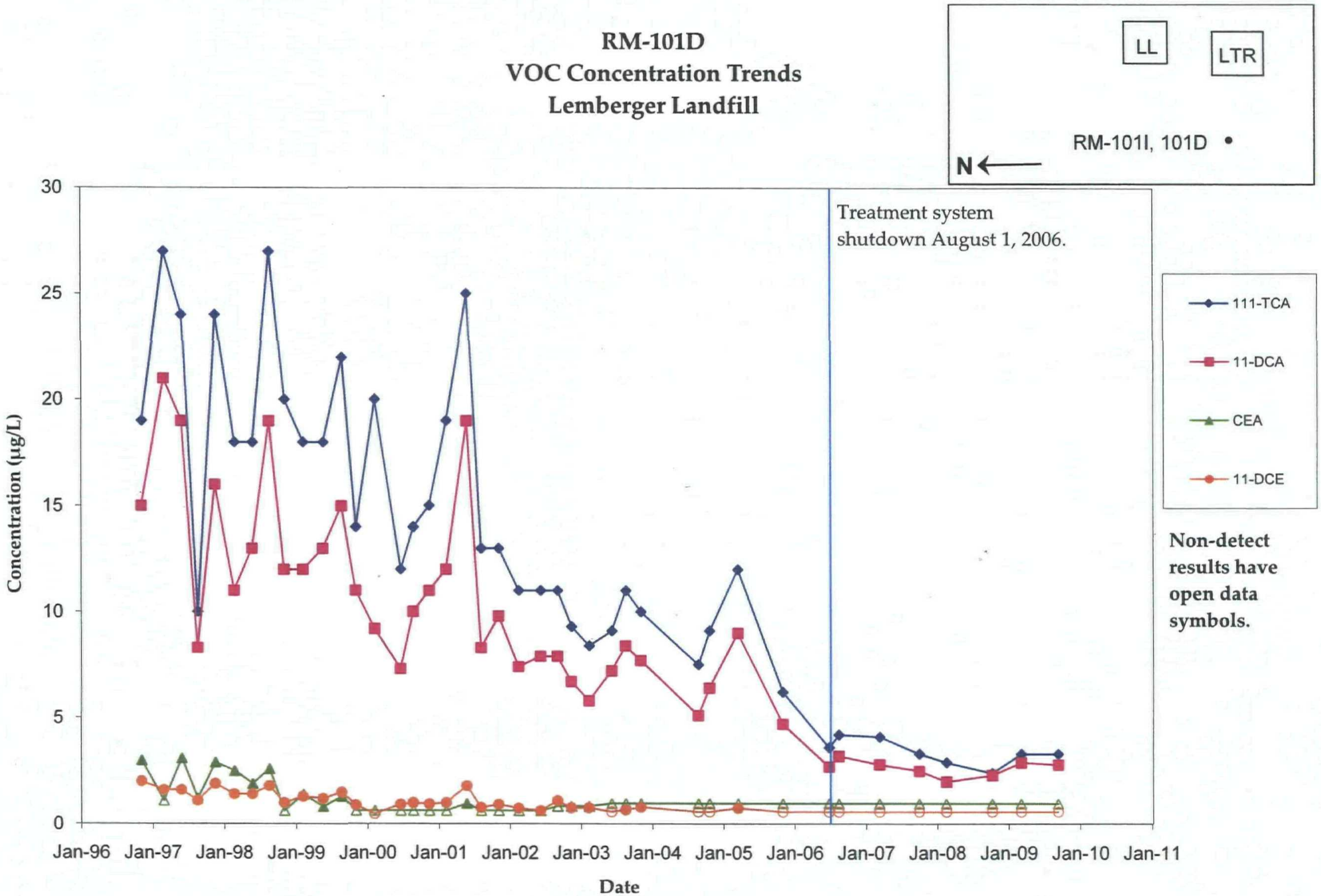




RM-010D
VOC Concentration Trends
Lemberger Landfill

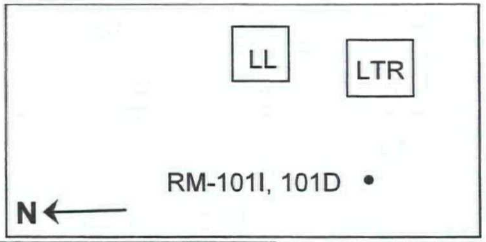


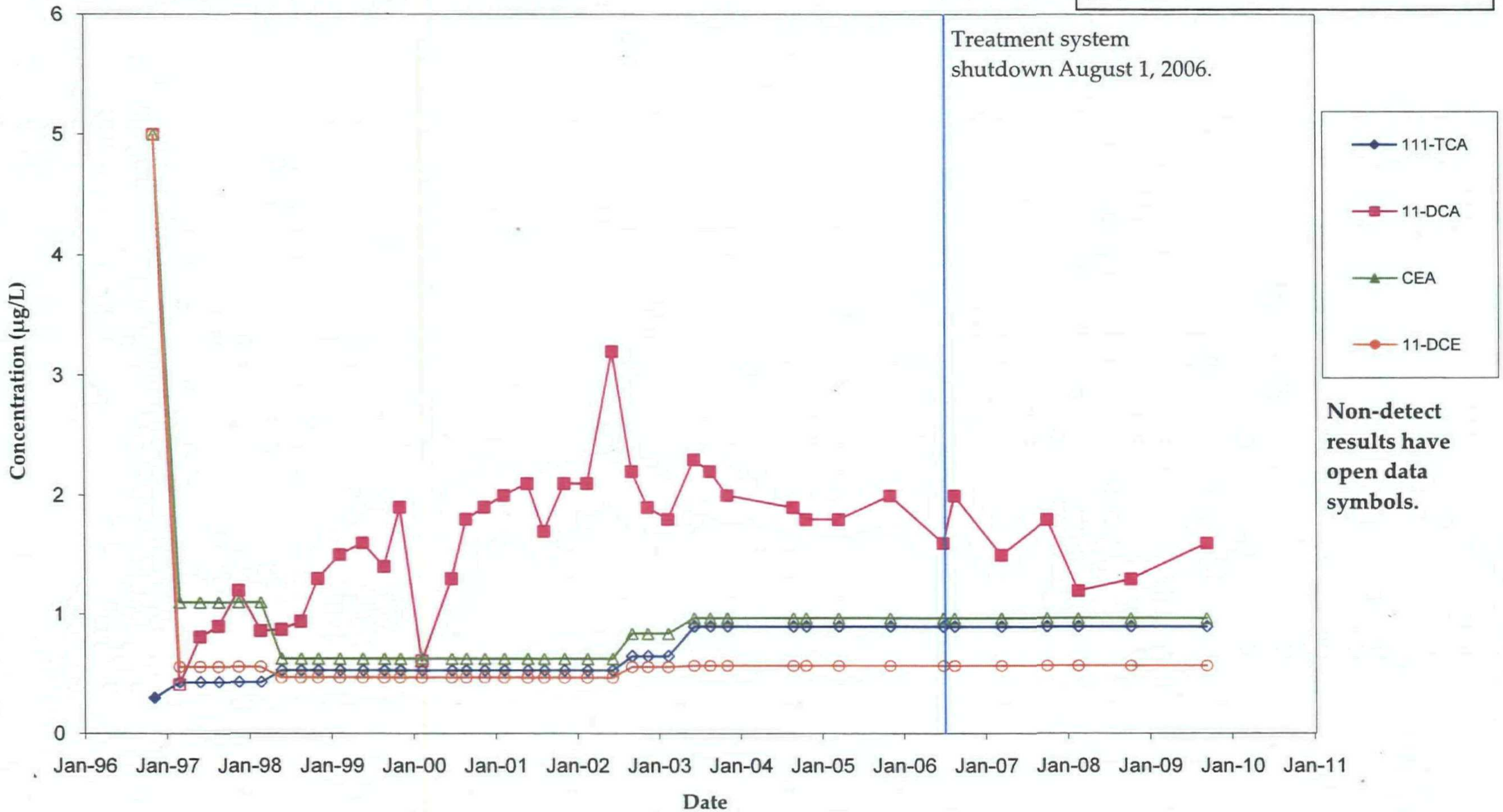
RM-101D
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.

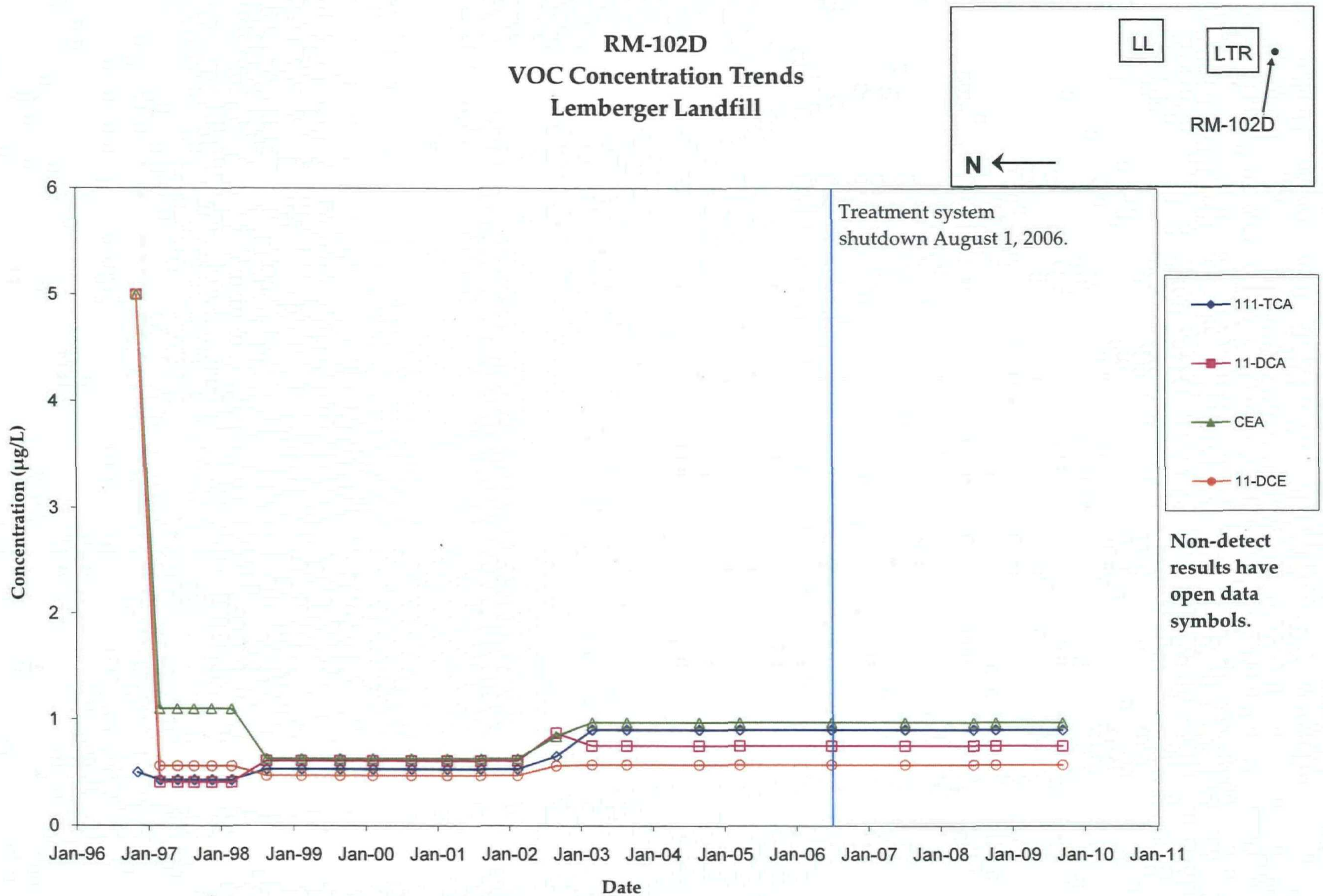
RM-101I
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

RM-102D
VOC Concentration Trends
Lemberger Landfill



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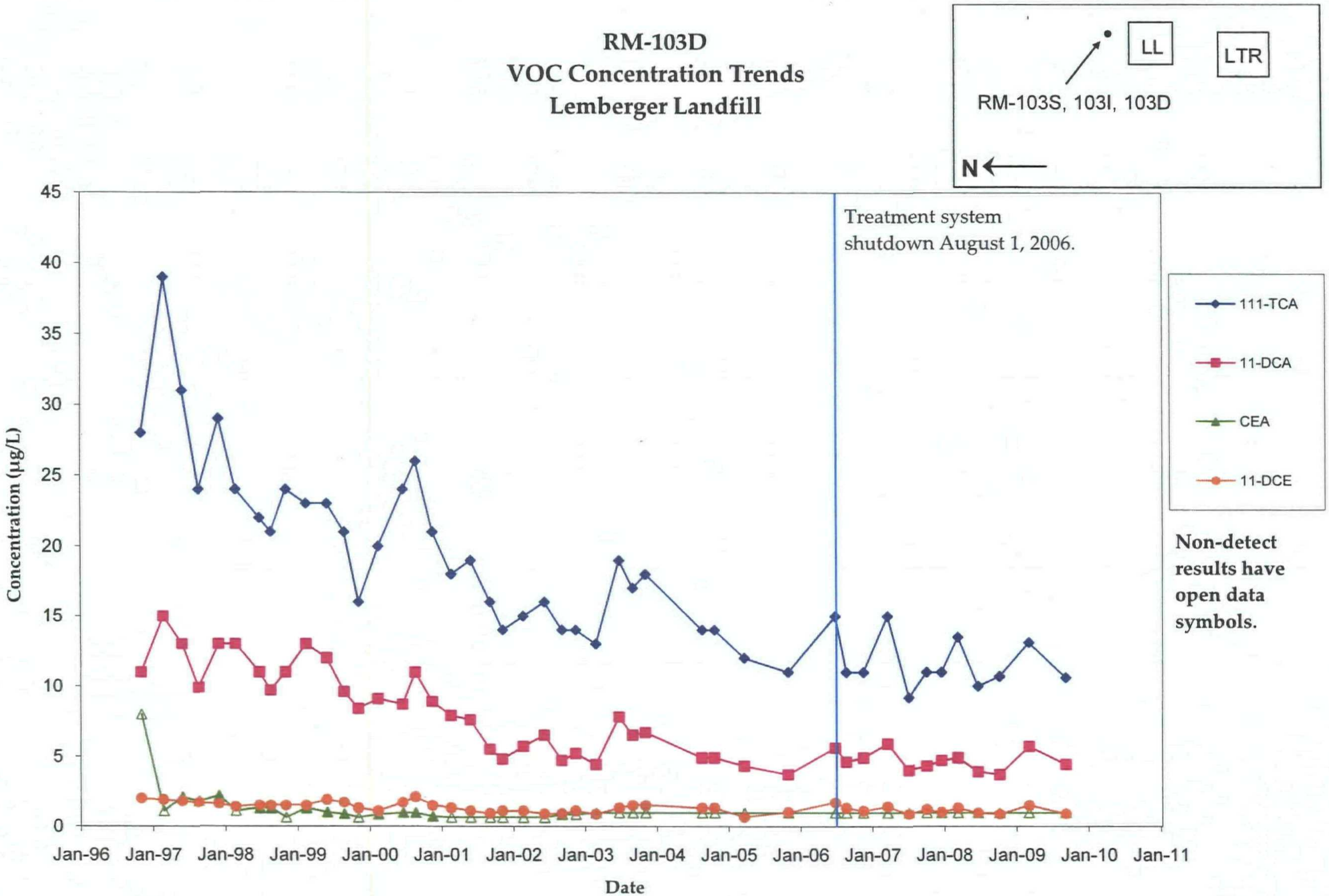

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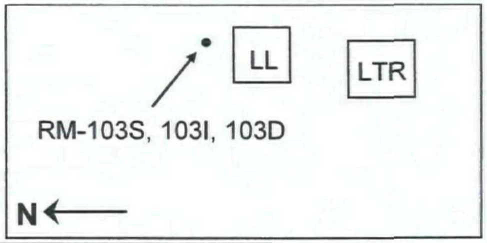
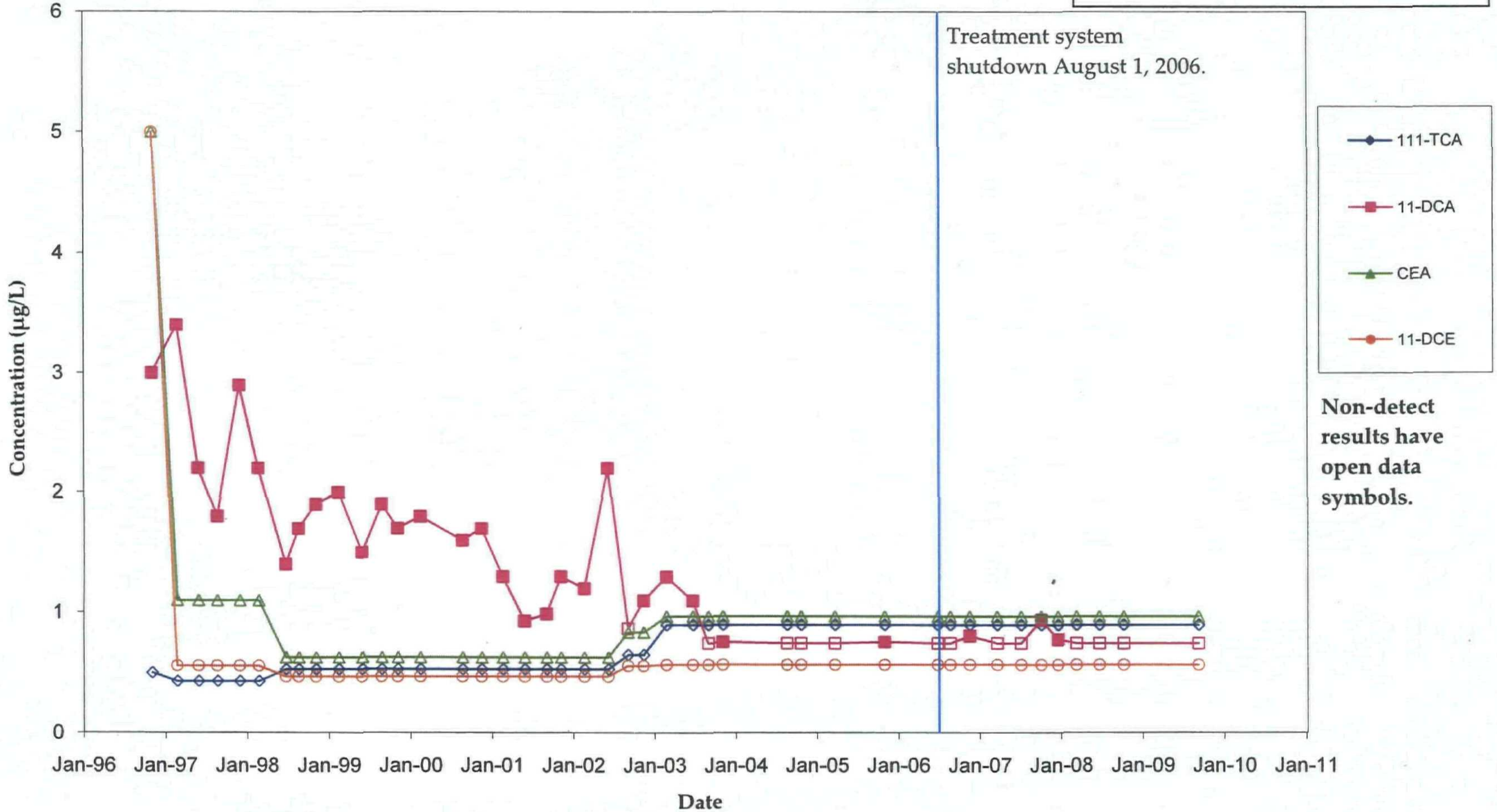
RM-103S
VOC Concentration Trends
Lemberger Landfill





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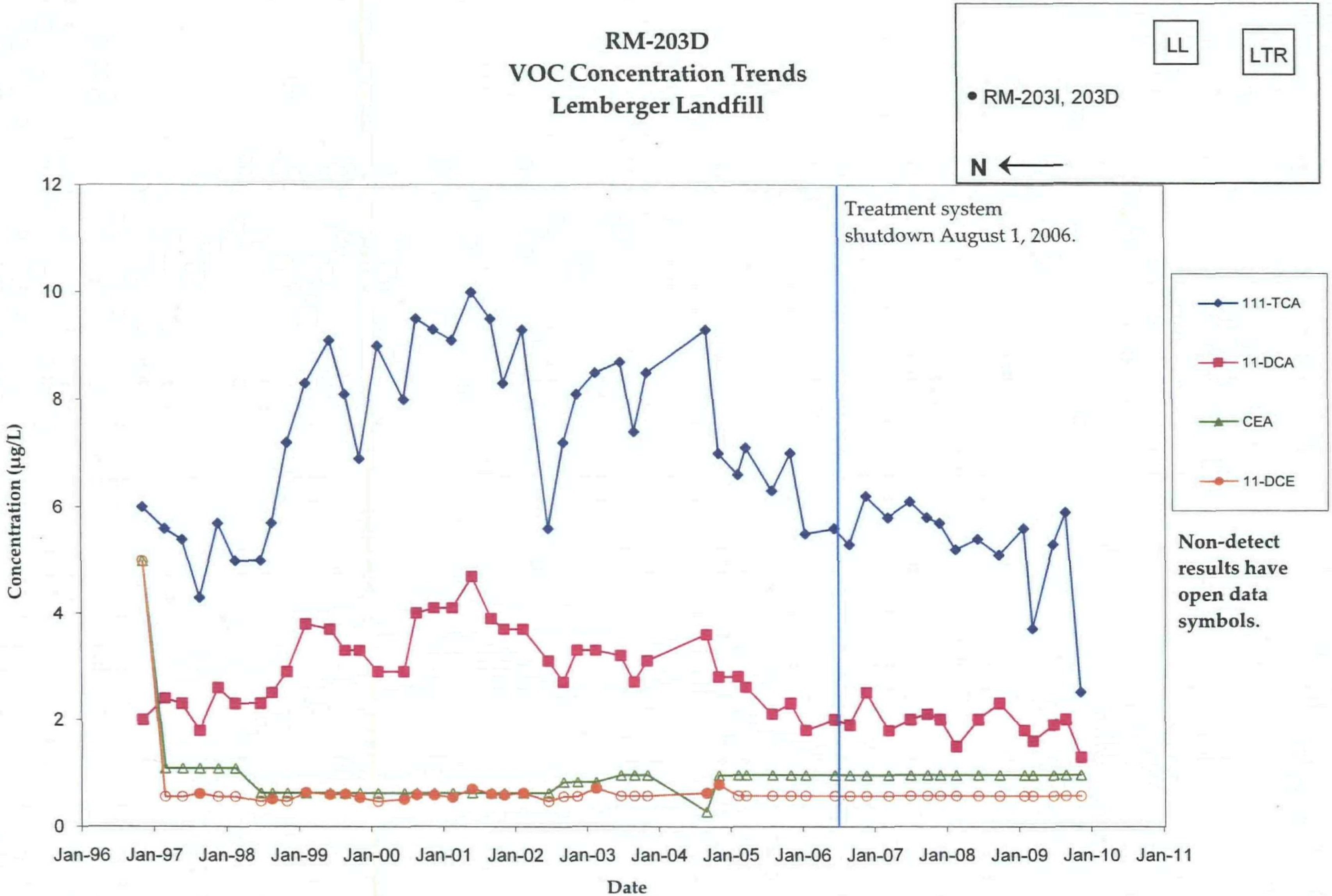
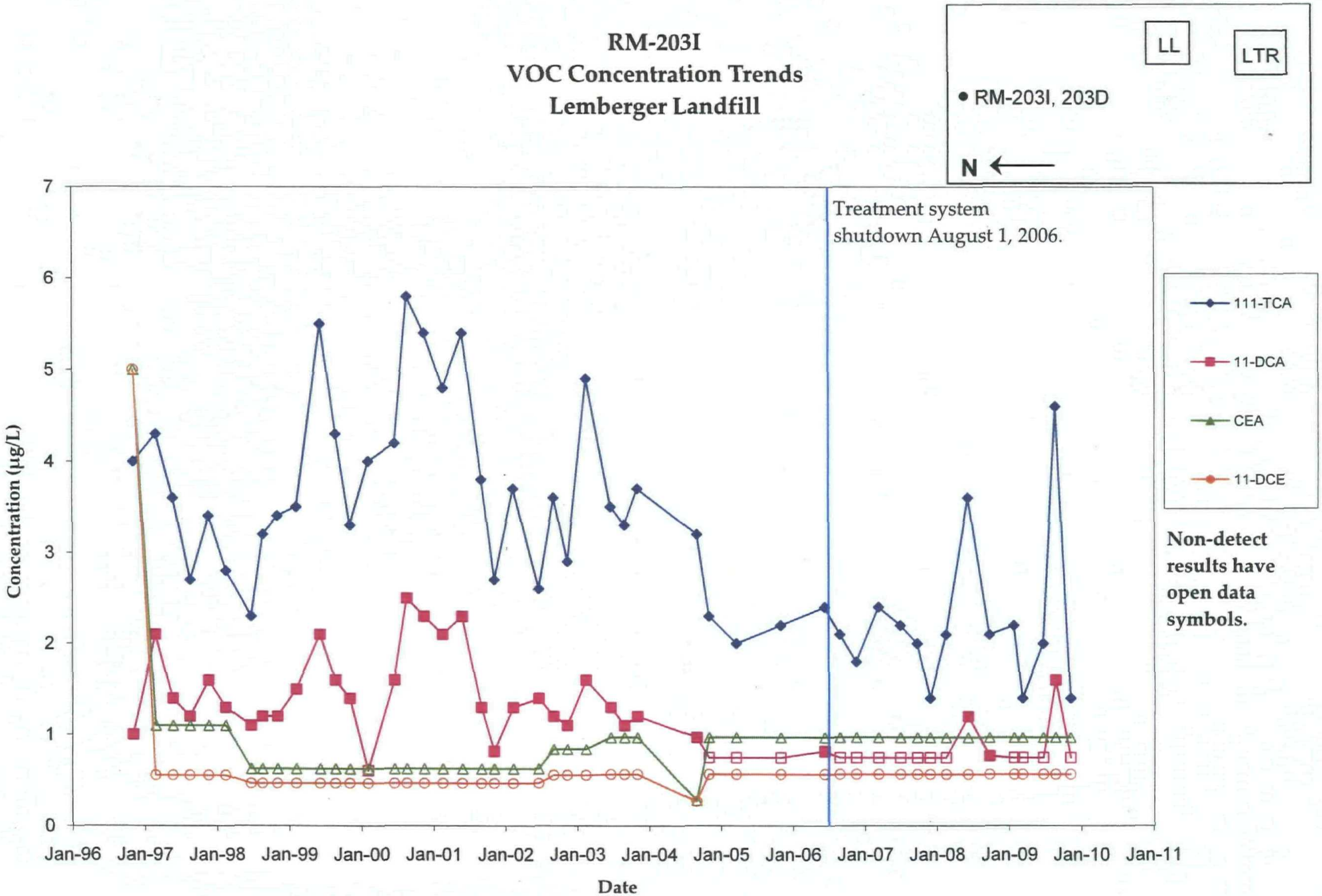
RM-203D
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.

C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ane TRENDS 02 2010.xlsm 4/5/2010



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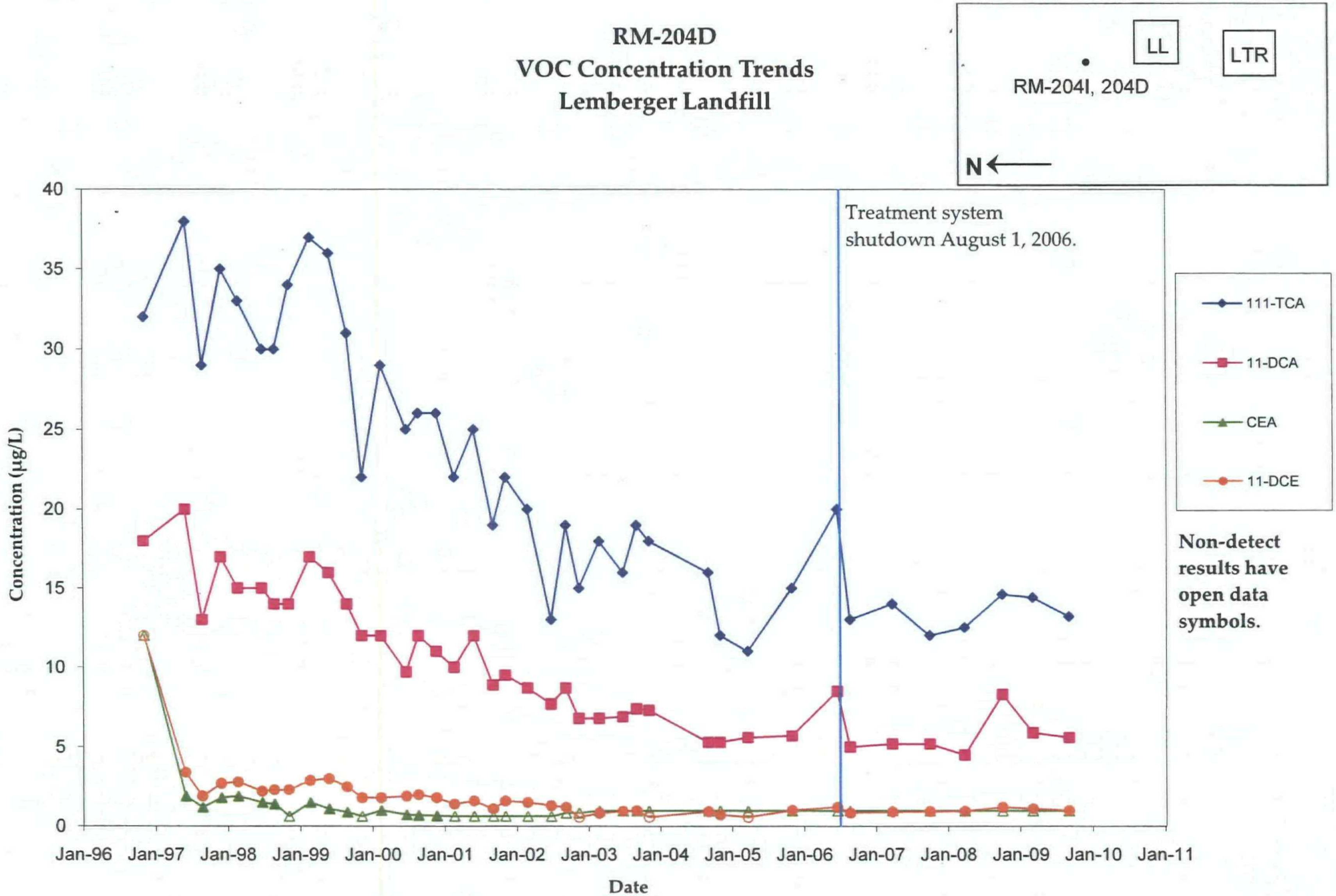
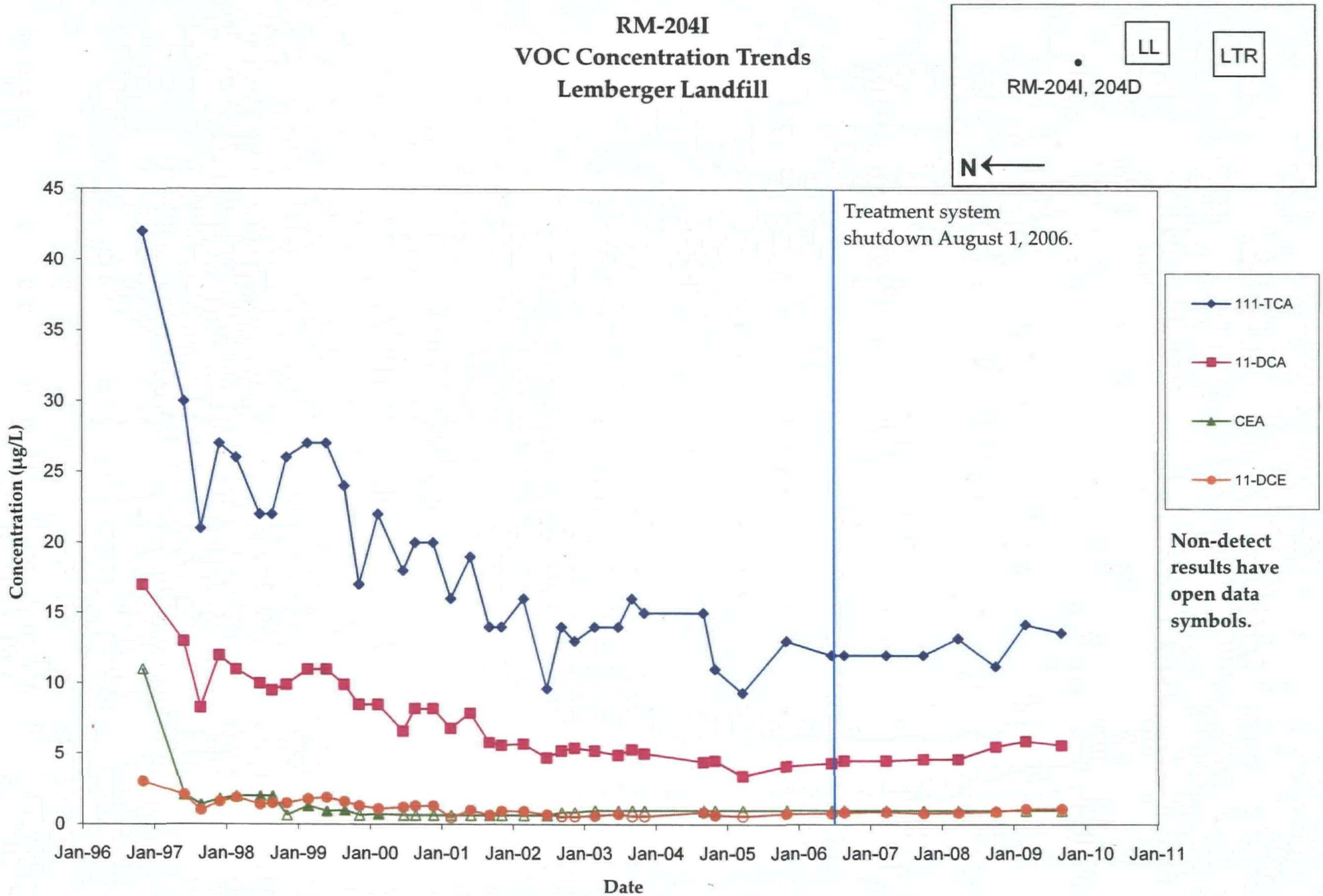
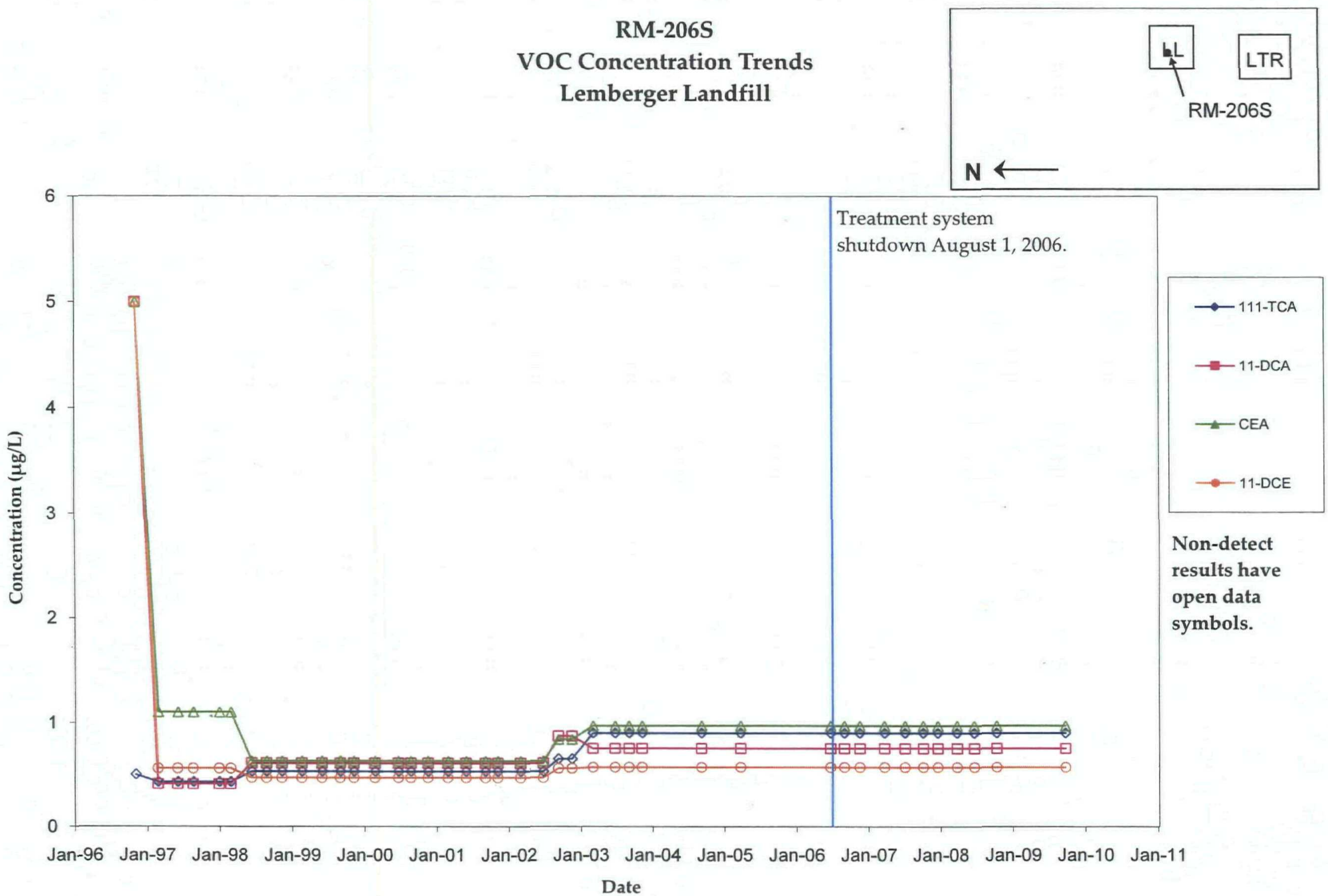
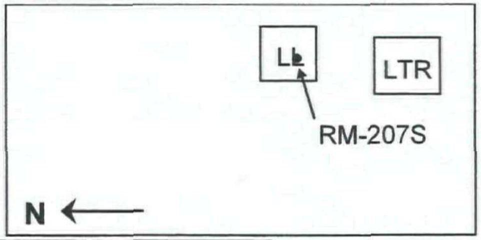
RM-204D
VOC Concentration Trends
Lemberger Landfill

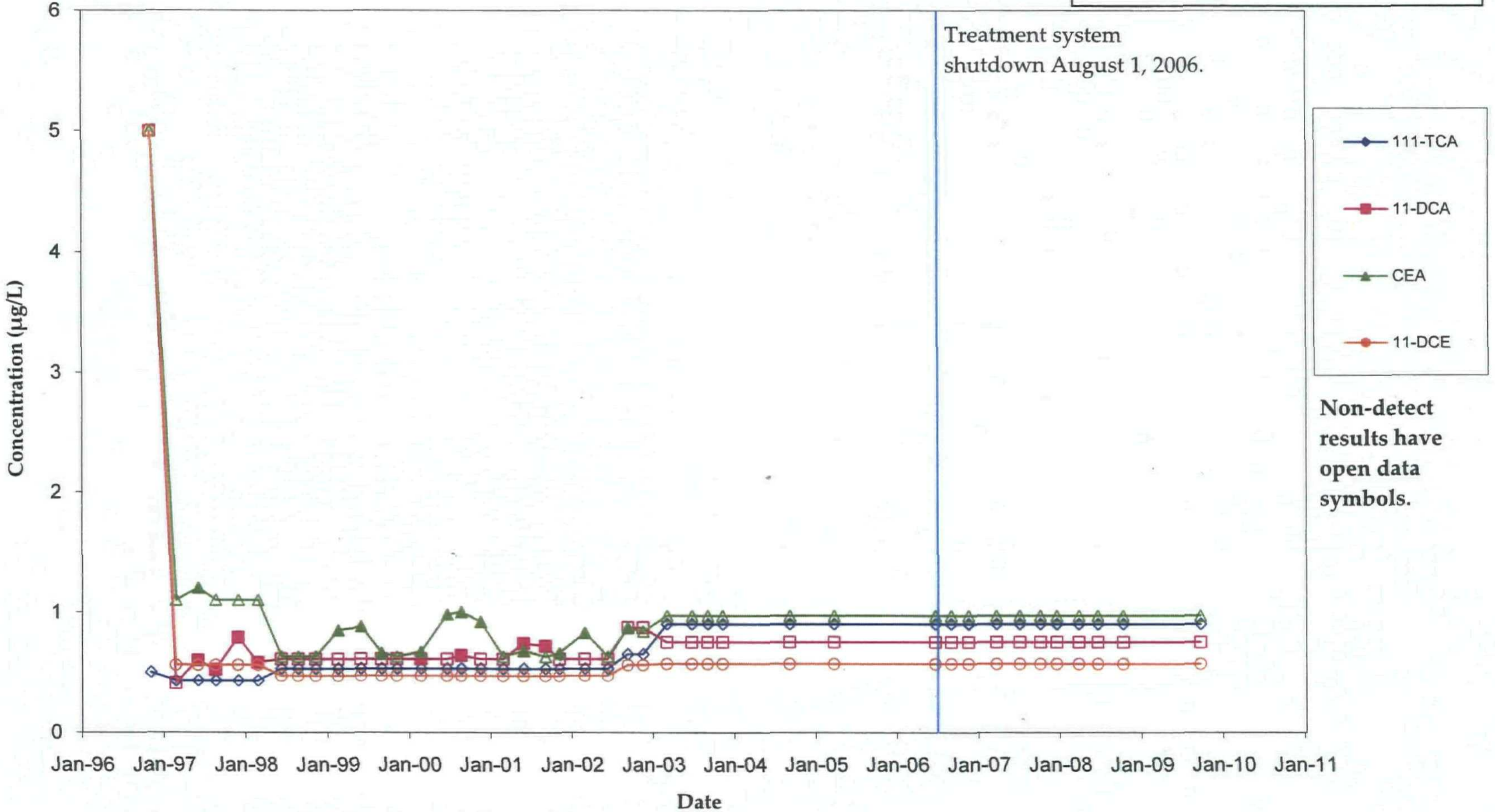



RM-204I
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-204I, 204D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
45
40
35
30
25
20
15
10
5
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.


RM-206S
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-206S
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
0
1
2
3
4
5
6
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date

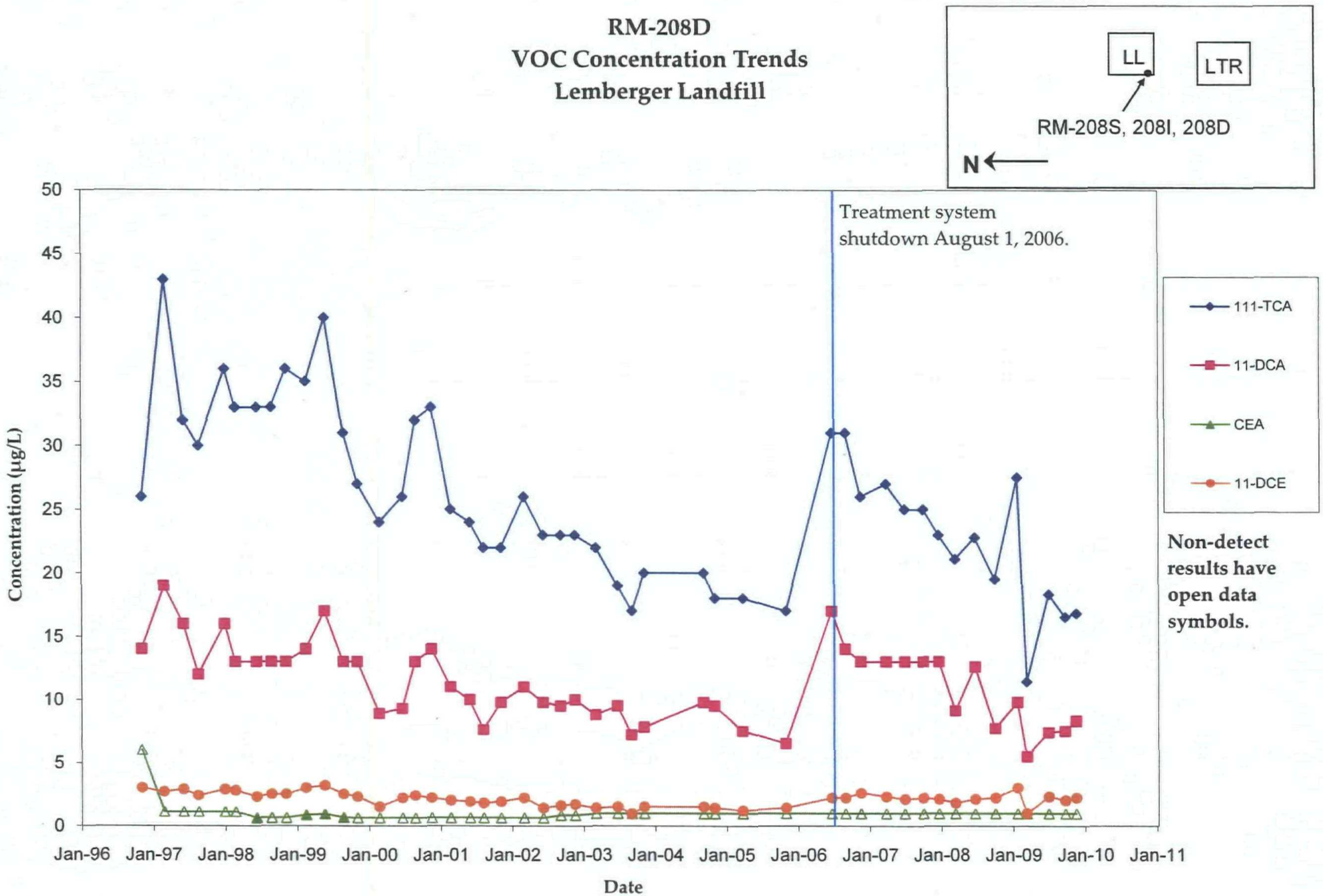
RM-207S
VOC Concentration Trends
Lemberger Landfill



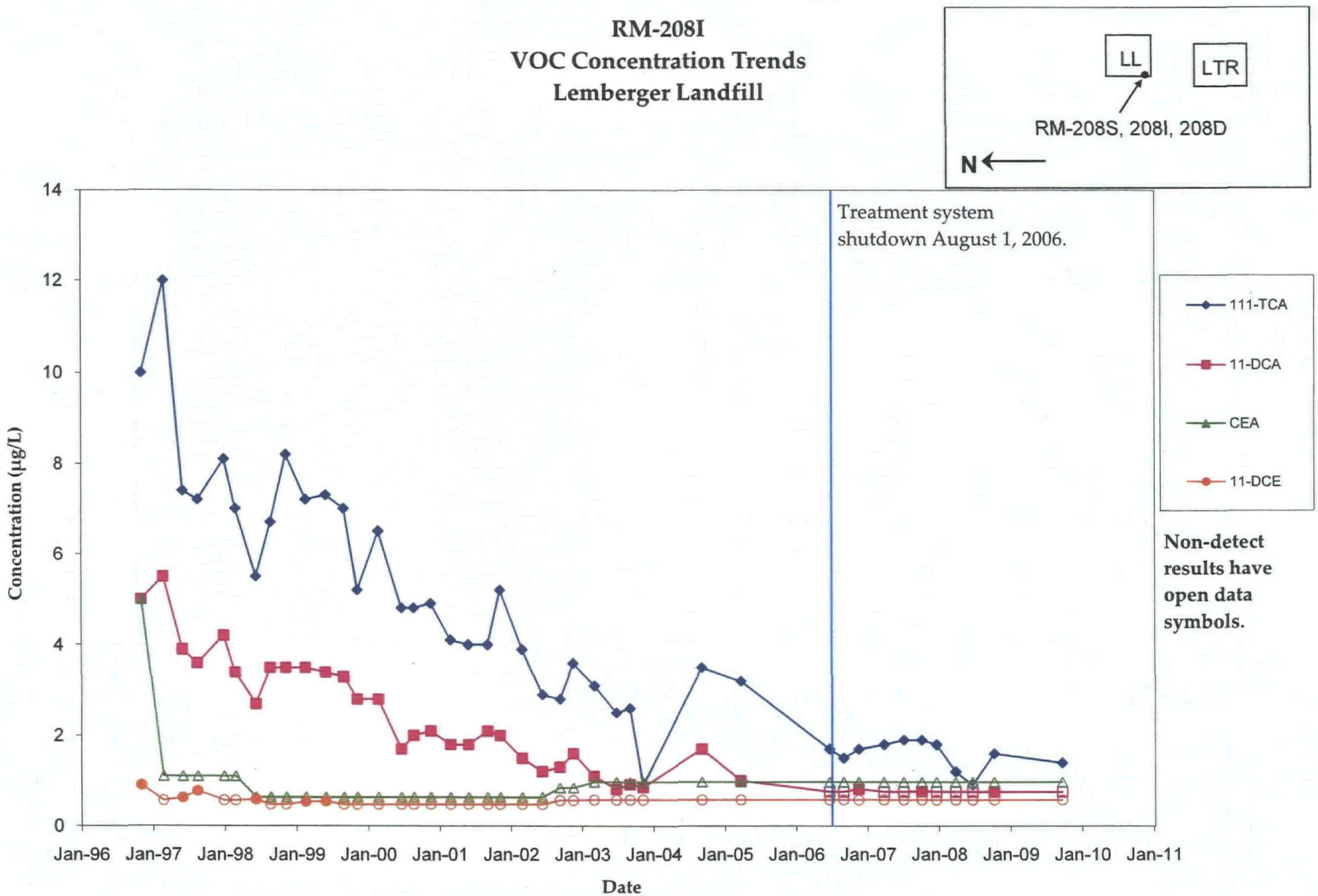


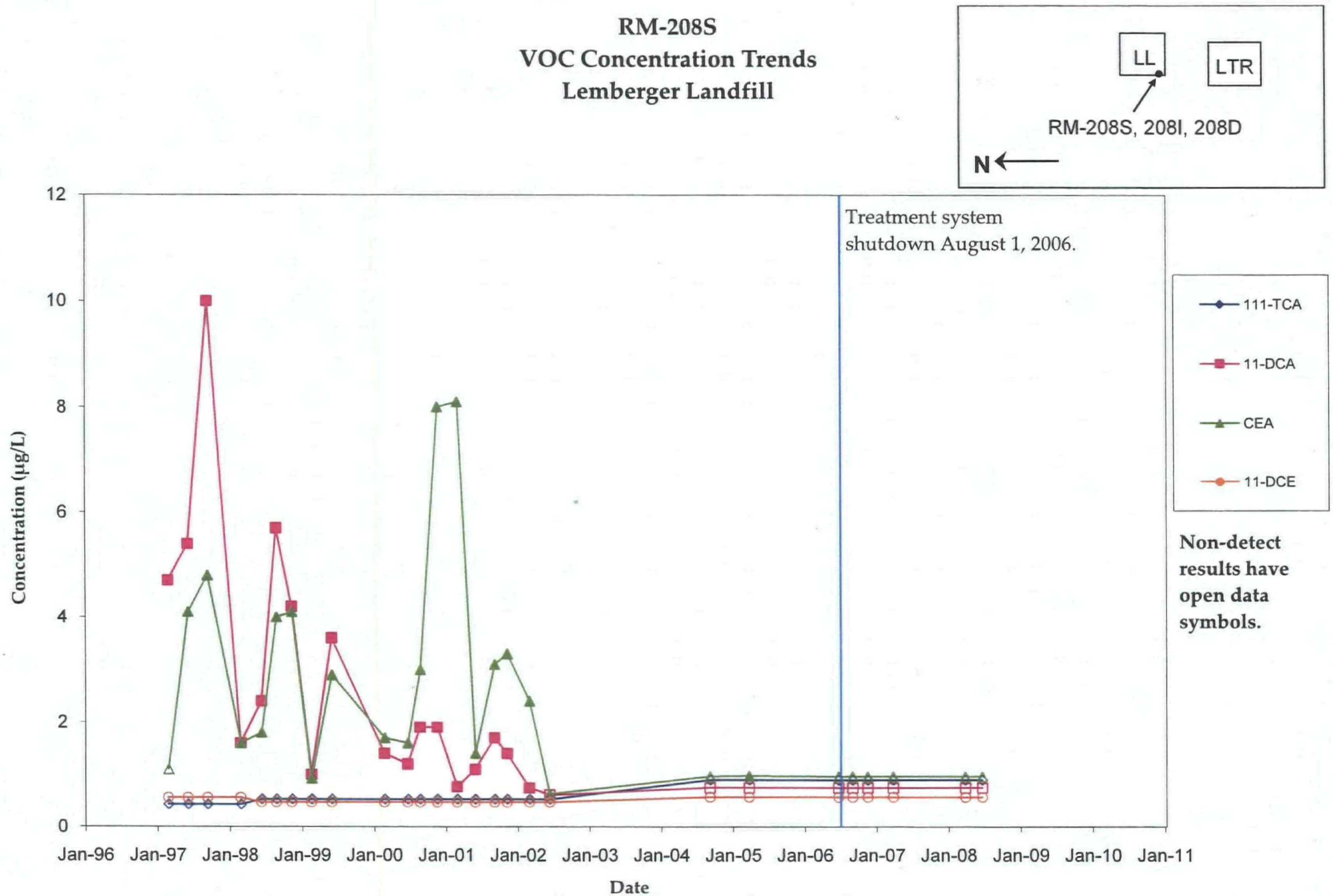
Non-detect results have open data symbols.

RM-208D
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.


RM-208I
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-208S, 208I, 208D
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
Date
0
2
4
6
8
10
12
14
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11



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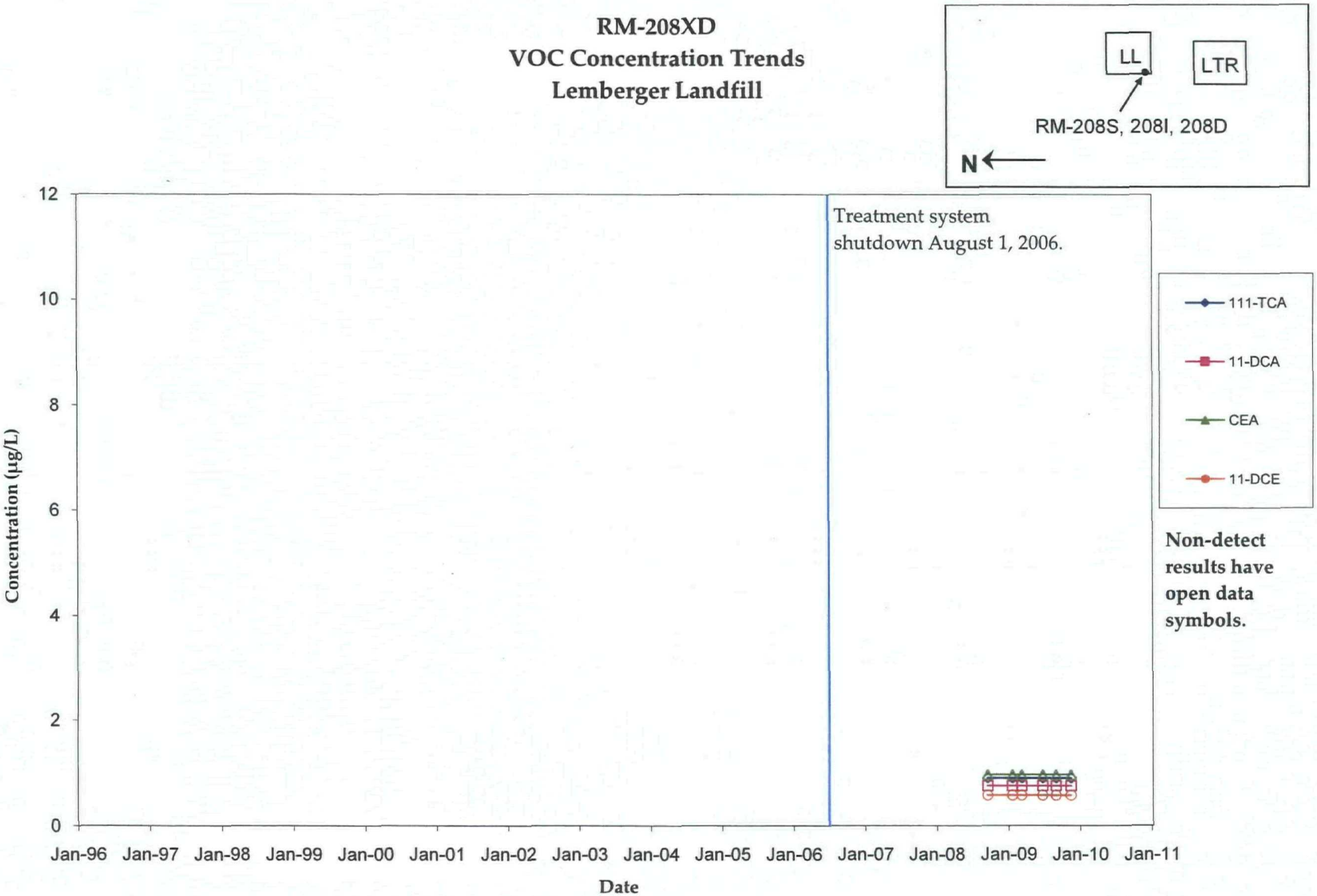
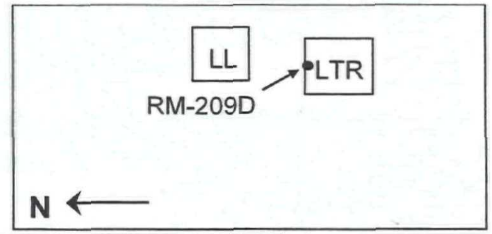
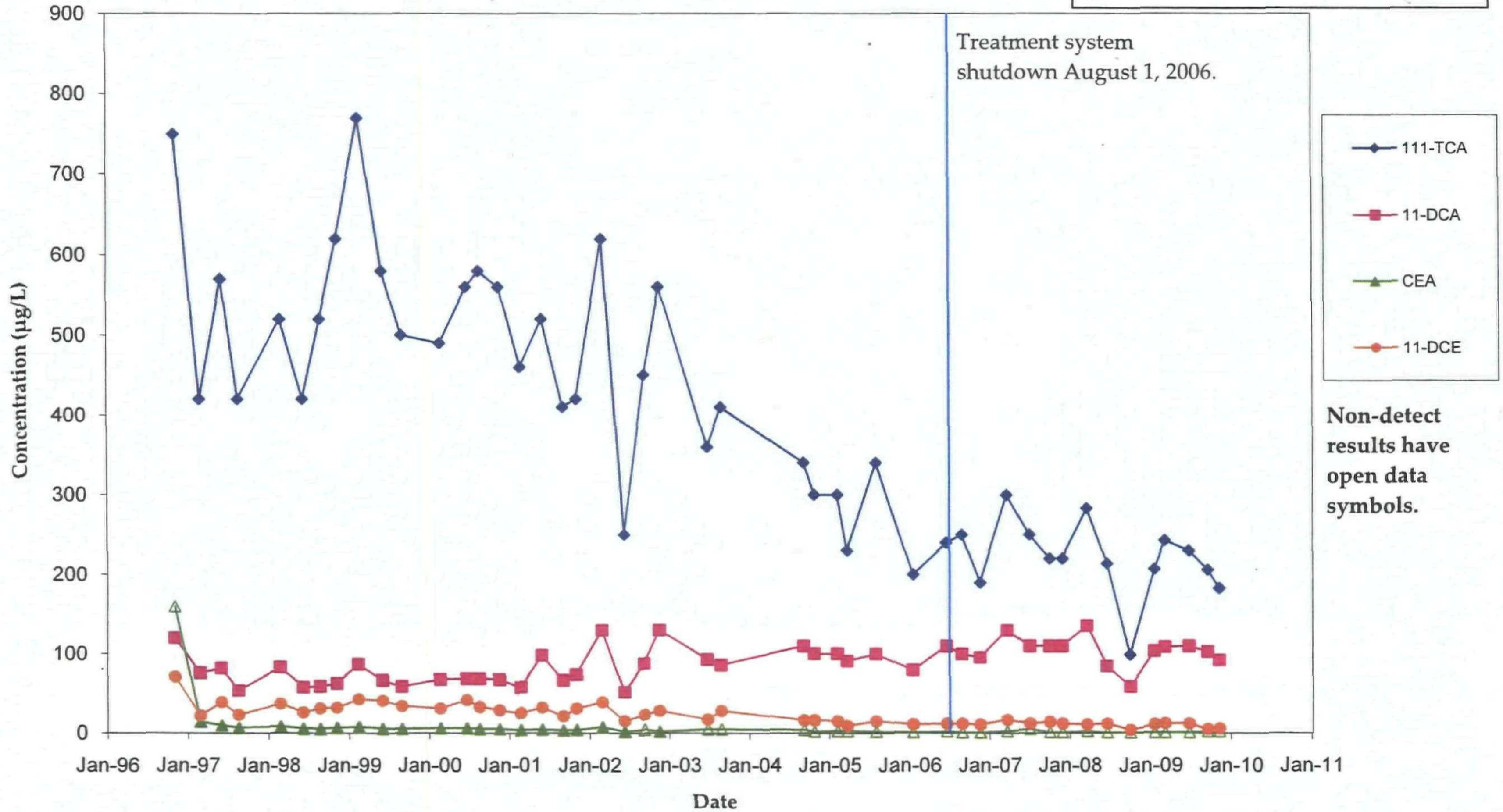


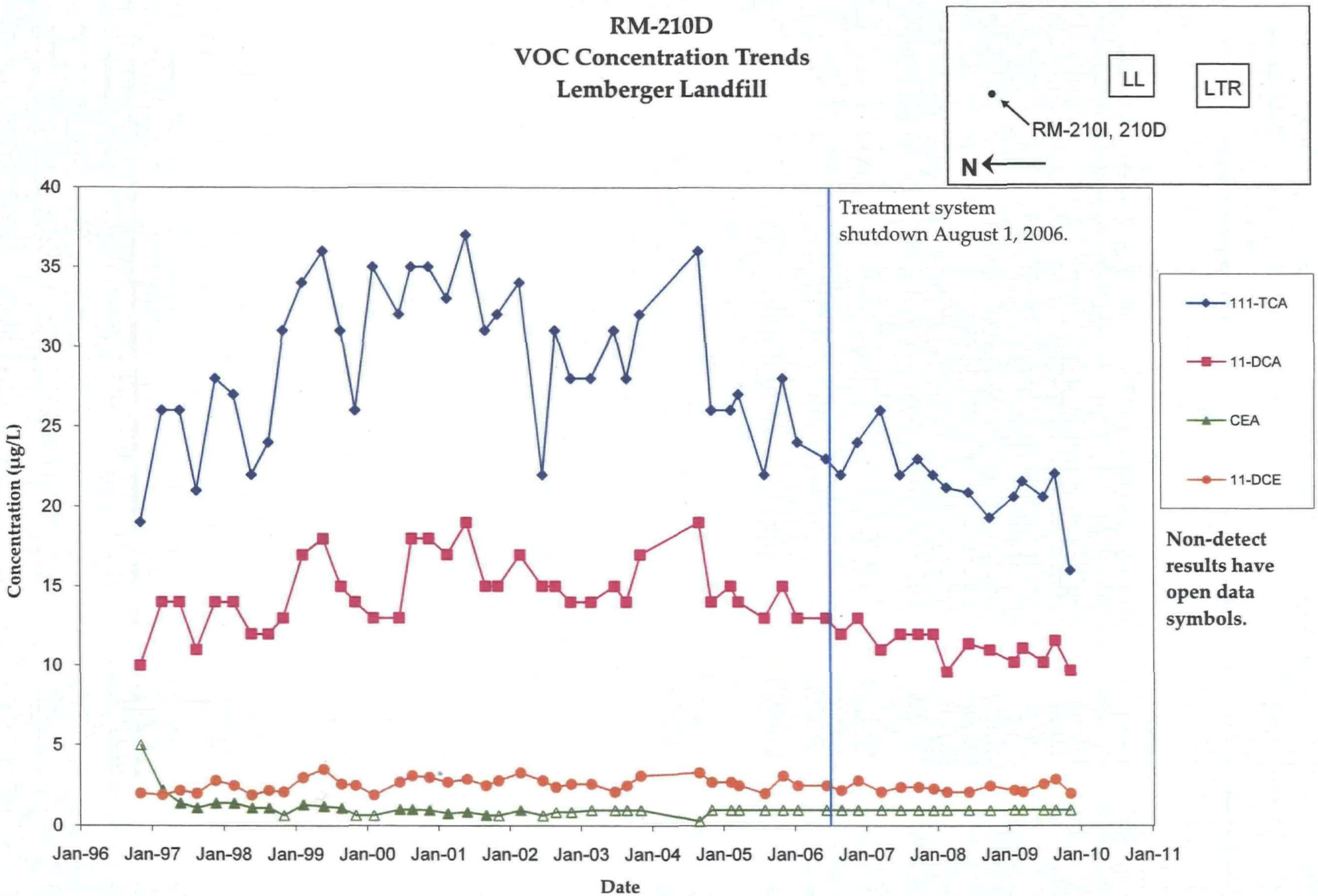
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ane TRENDS 02 2010.xlsm 4/5/2010

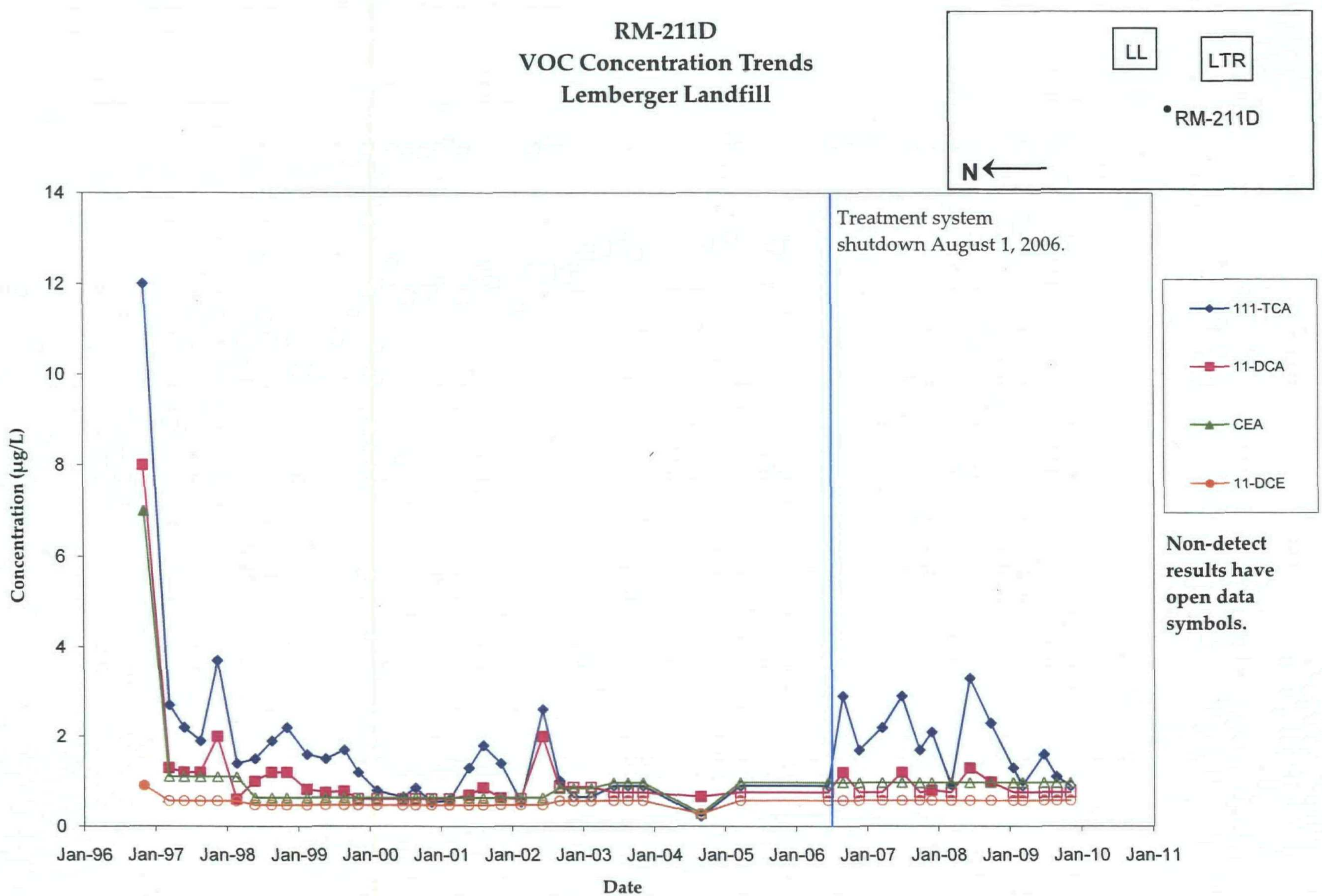
RM-209D
VOC Concentration Trends
Lemberger Landfill

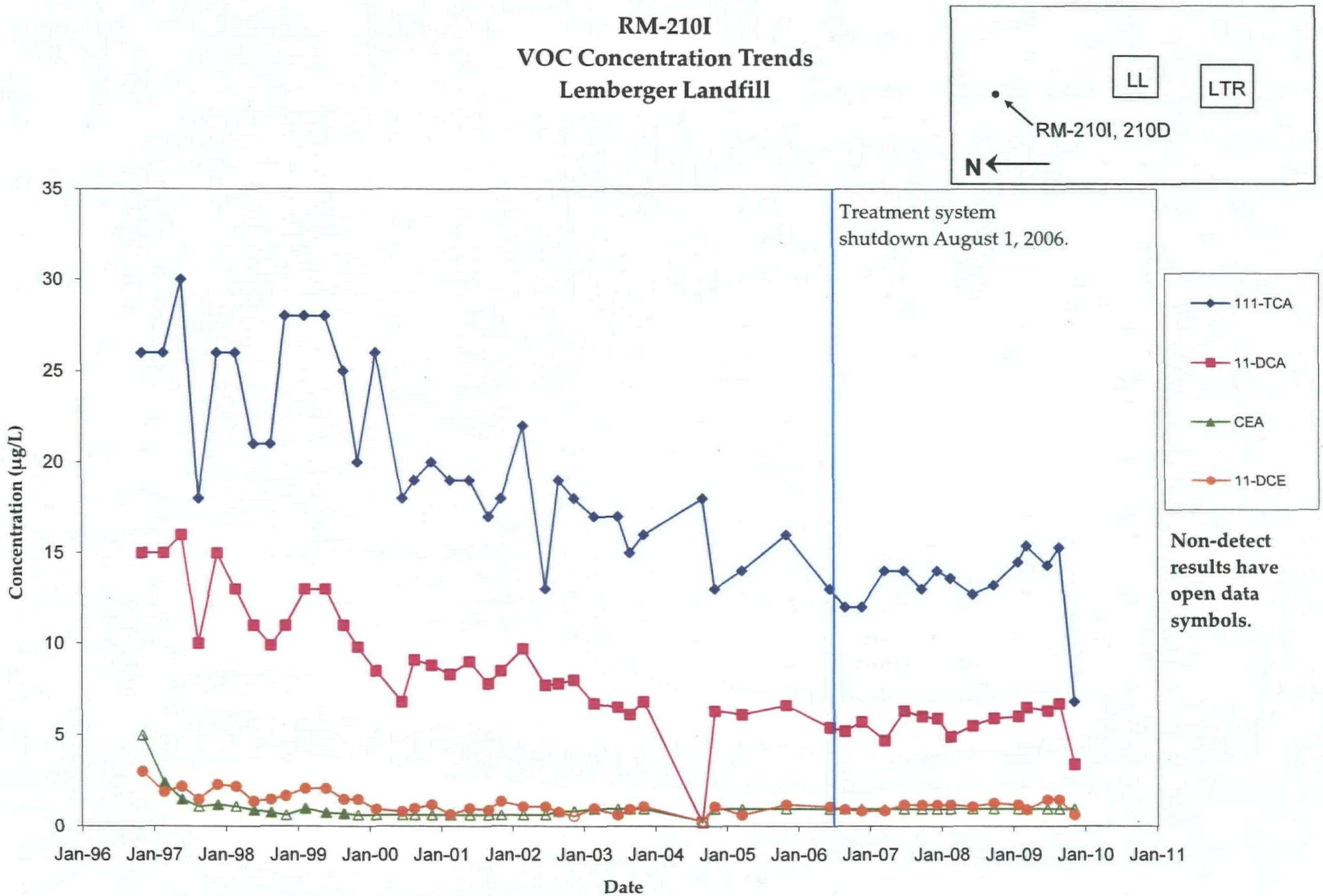


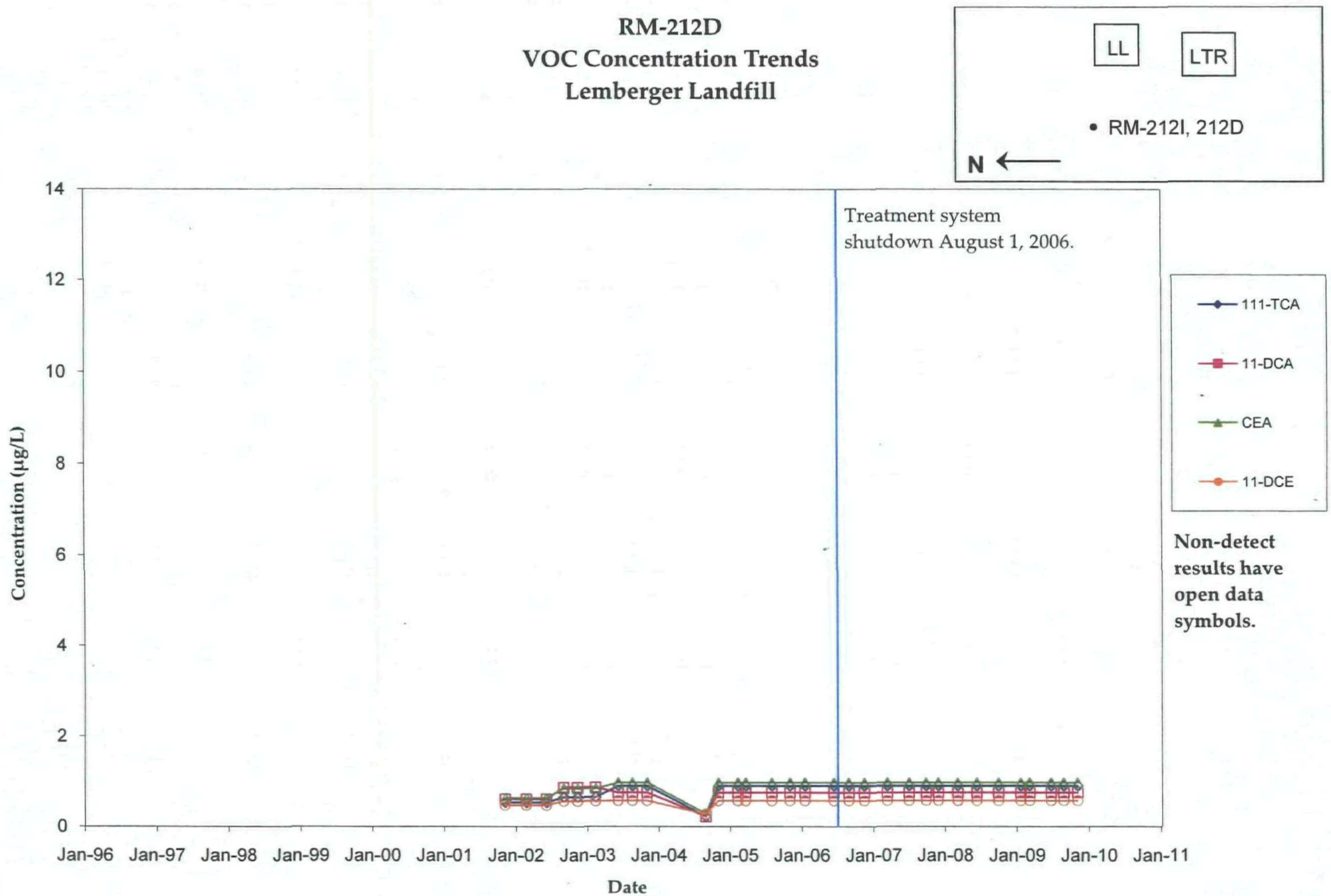


Non-detect results have open data symbols.

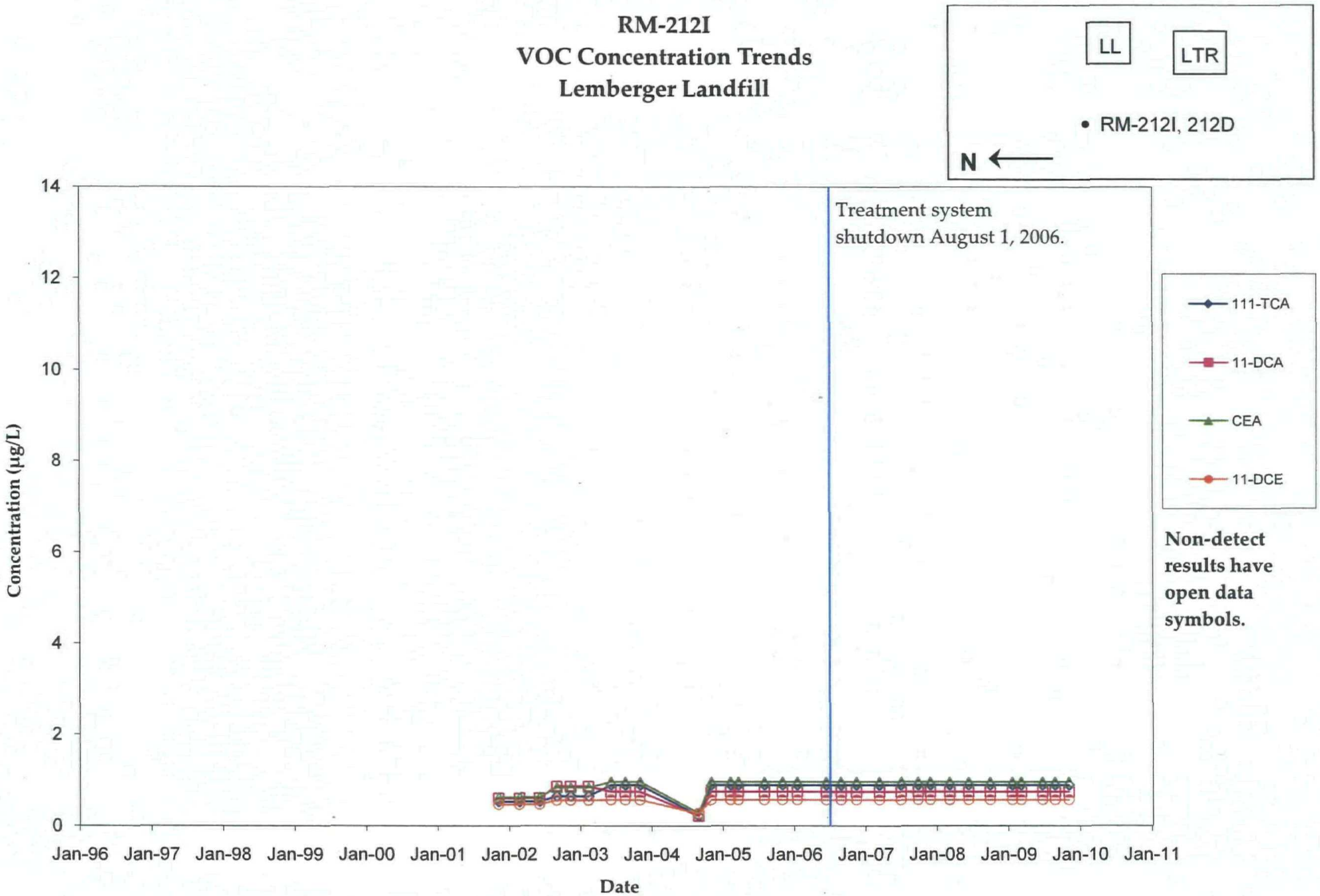

RM-210D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-210I, 210D
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
0
5
10
15
20
25
30
35
40
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date


RM-211D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-211D
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
0
2
4
6
8
10
12
14
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date


RM-210I
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-210I, 210D
N
Treatment system shutdown August 1, 2006.
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.
Concentration (µg/L)
35
30
25
20
15
10
5
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date

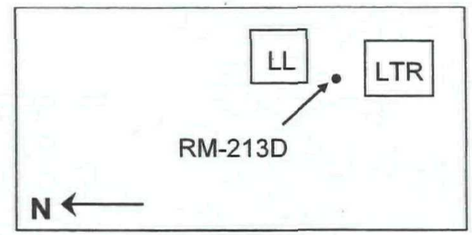


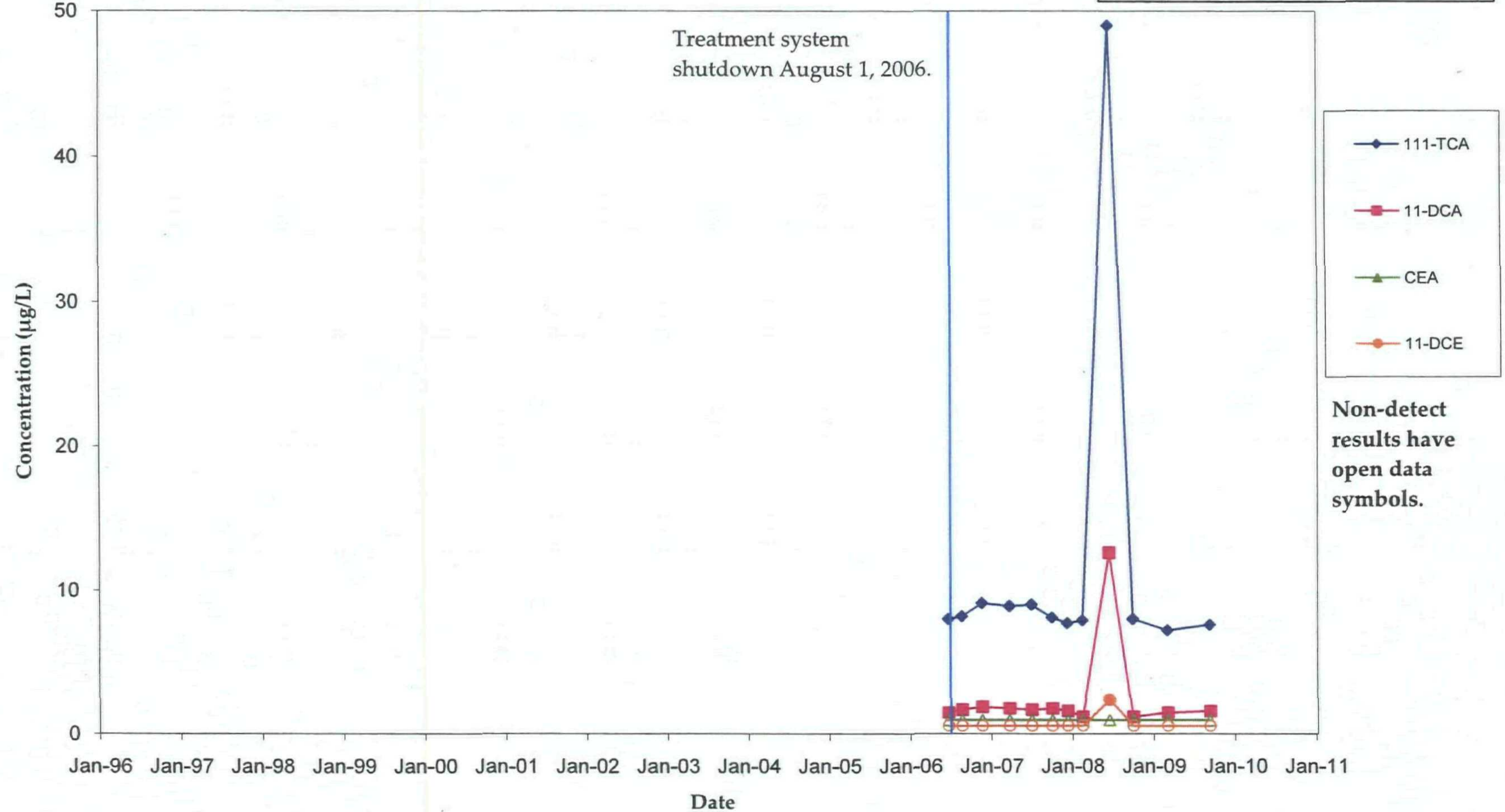
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ane TRENDS 02 2010.xlsm 4/5/2010



C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ane TRENDS 02 2010.xlsm 4/5/2010

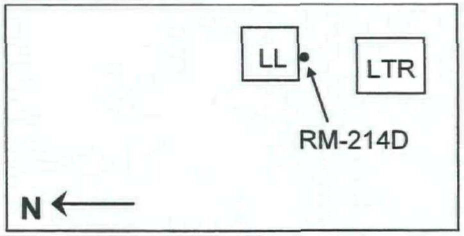
RM-213D
VOC Concentration Trends
Lemberger Landfill

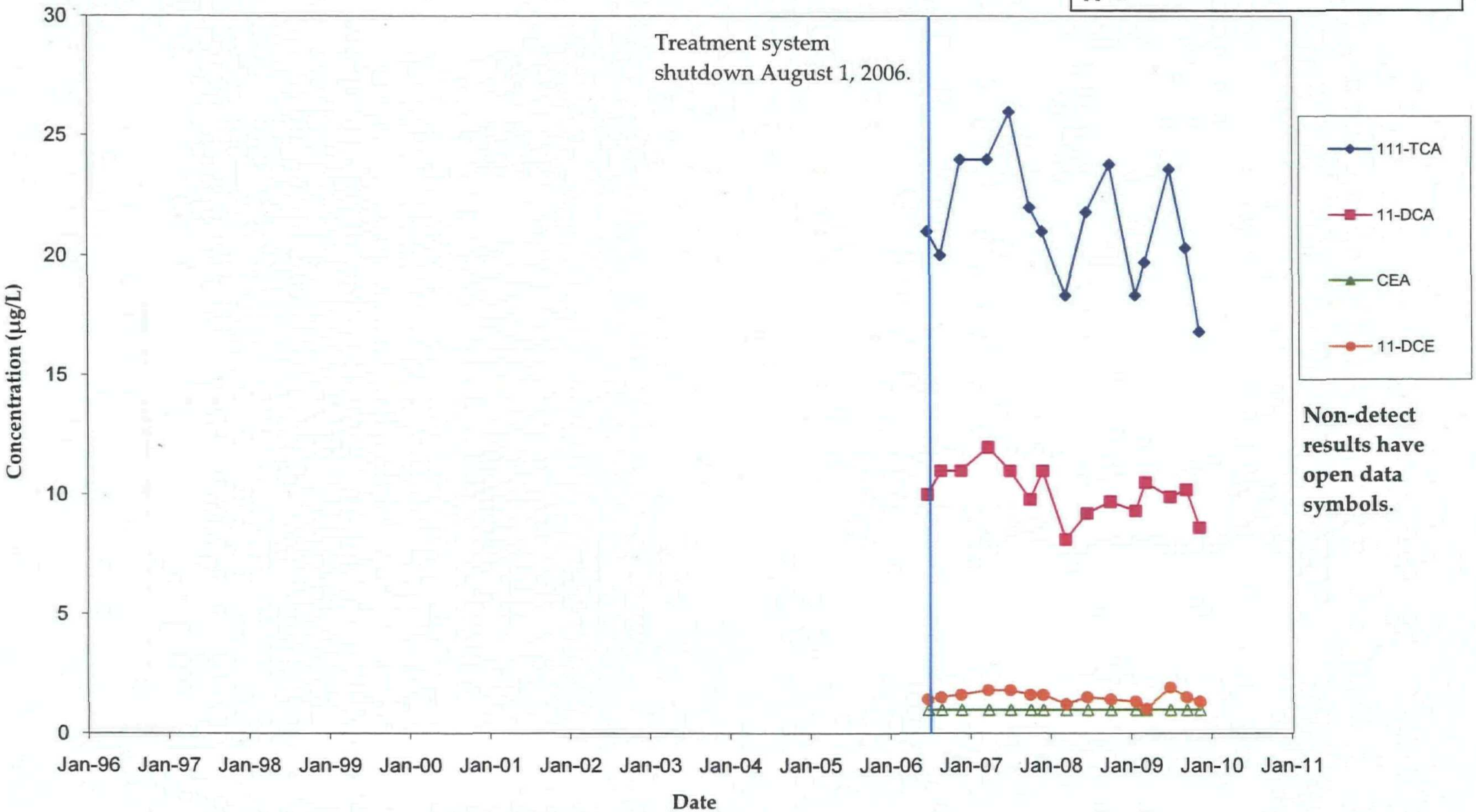




Non-detect results have open data symbols.

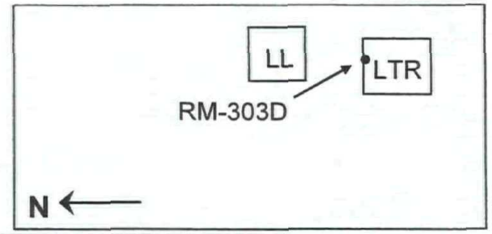
RM-214D
VOC Concentration Trends
Lemberger Landfill

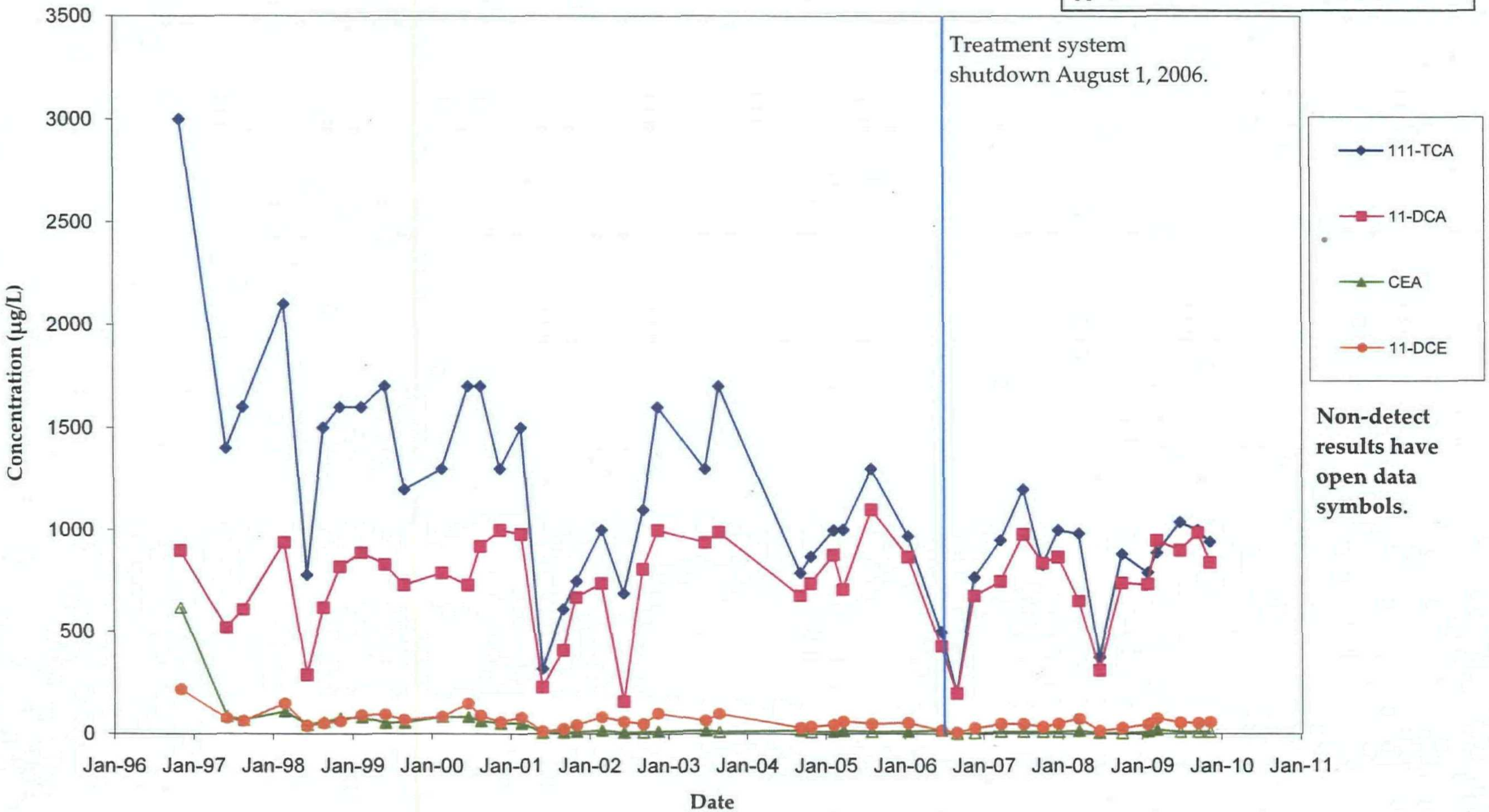




Non-detect results have open data symbols.

RM-303D
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

RM-304D
VOC Concentration Trends
Lemberger Landfill

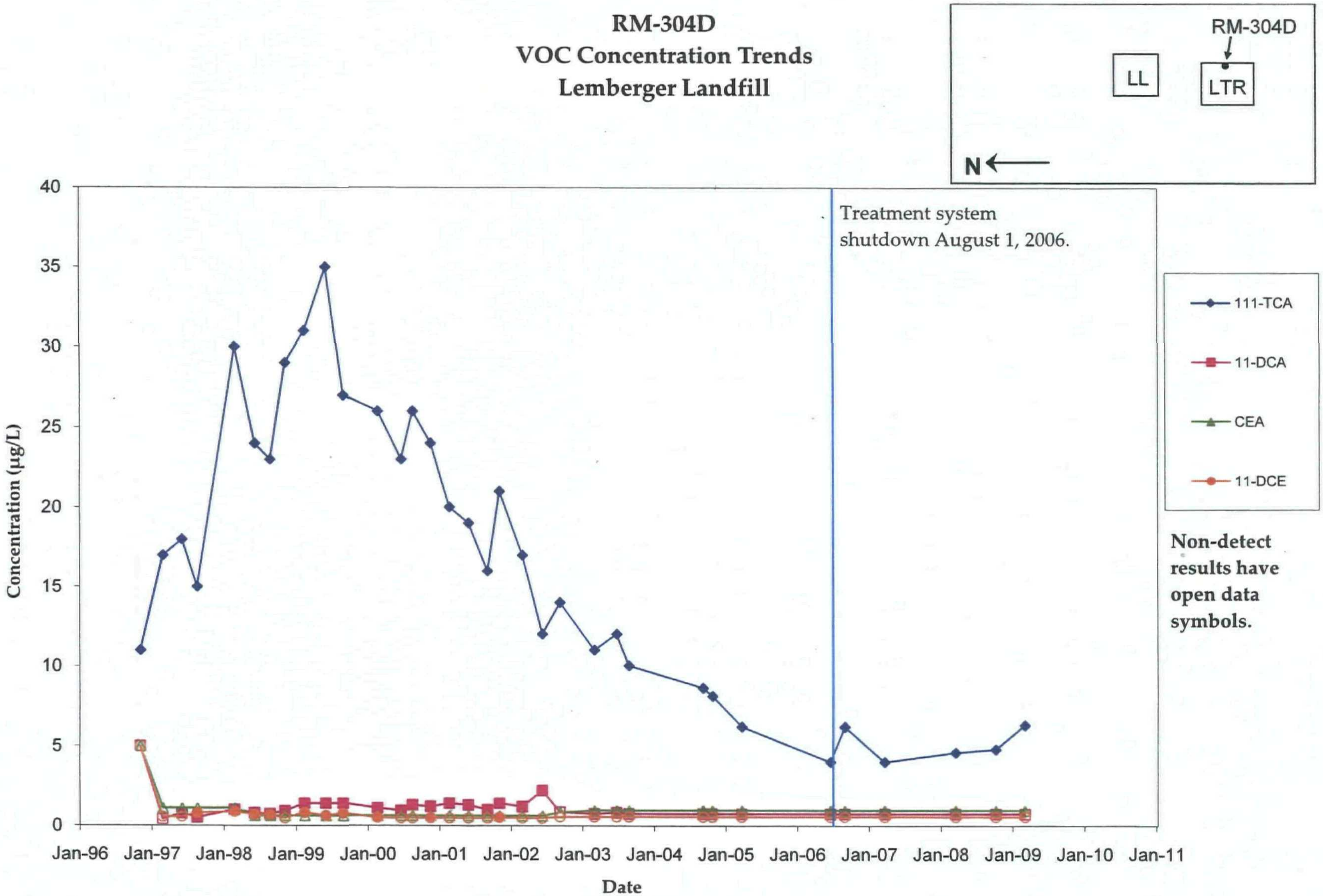
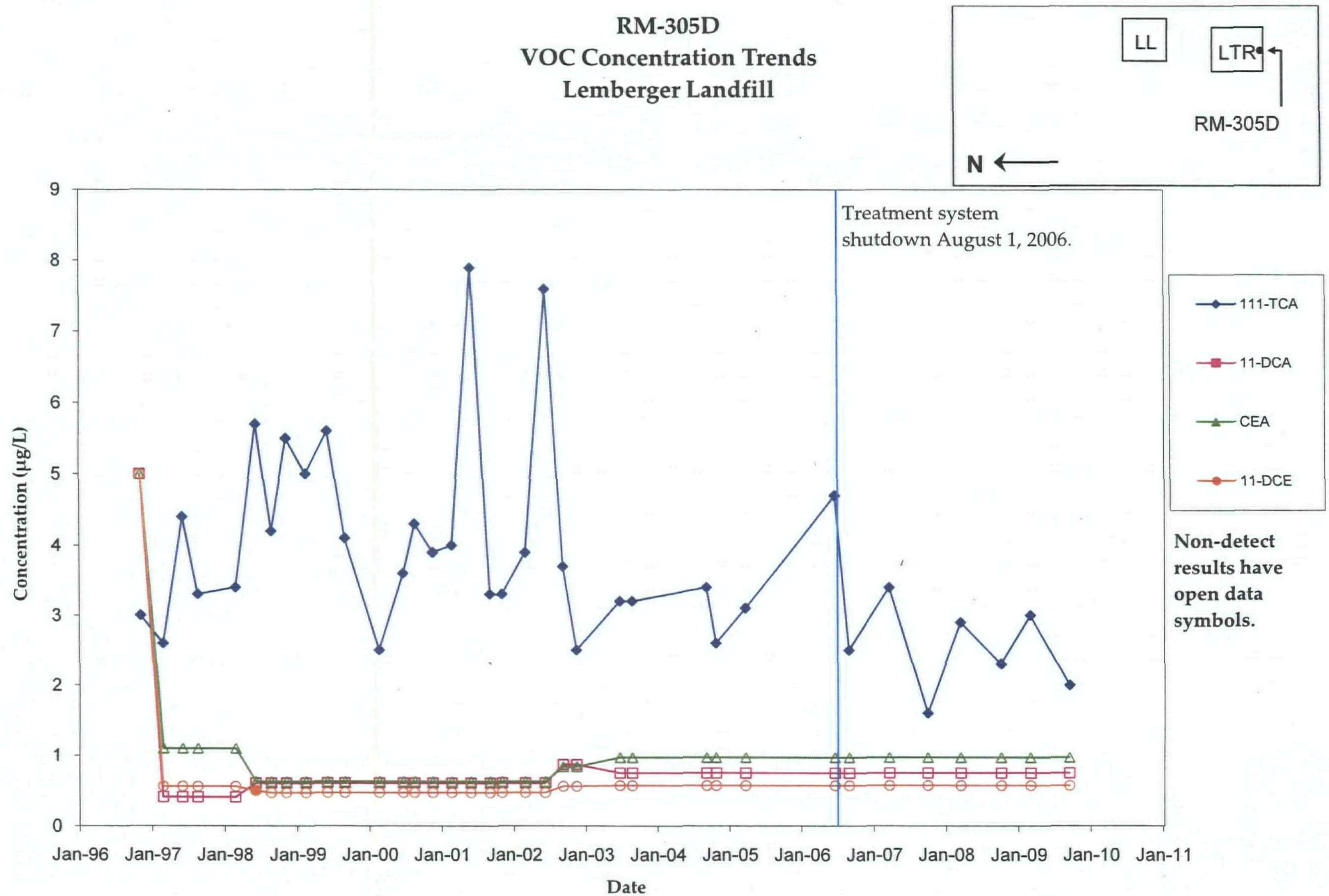
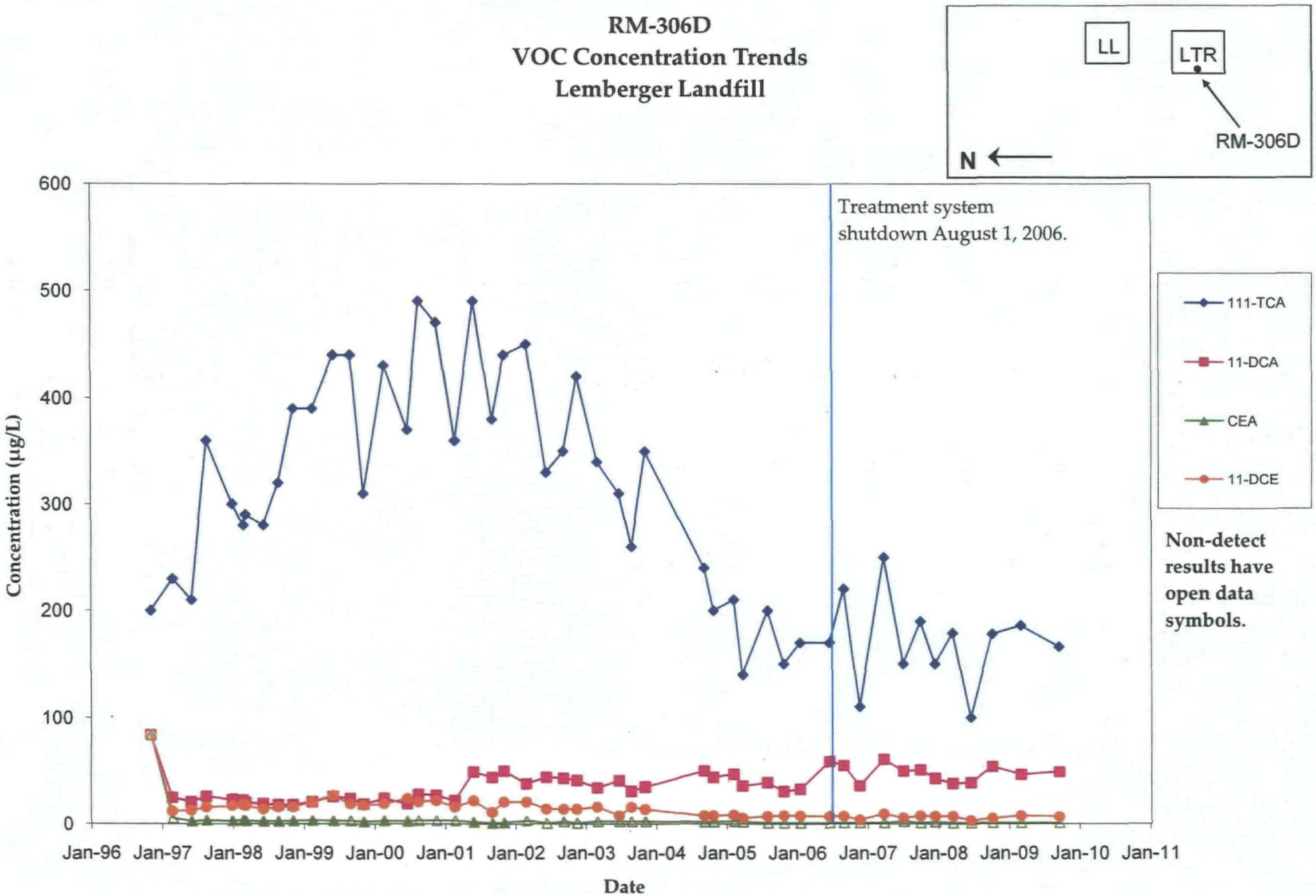


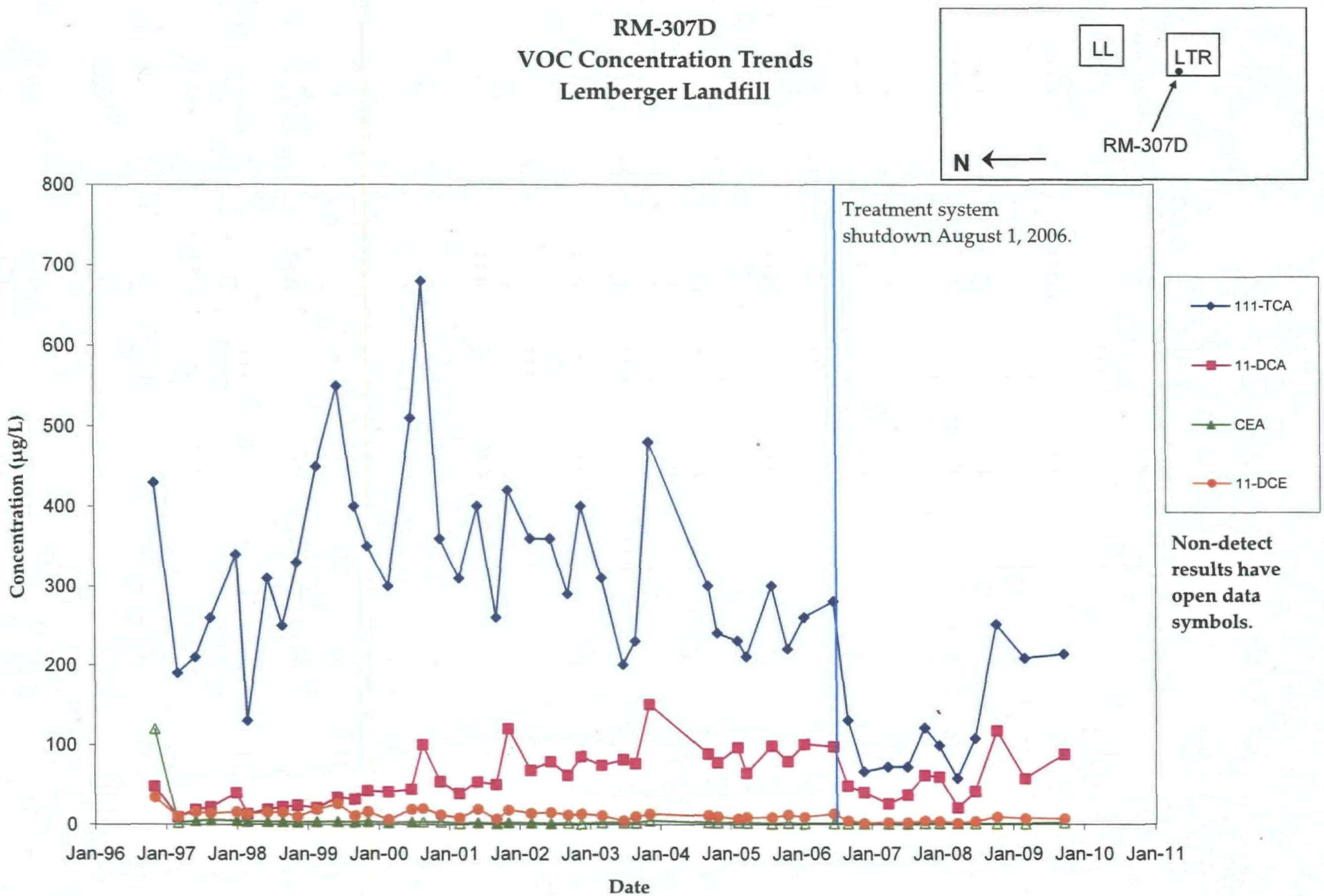
Exhibit 27
Page 51 of 108



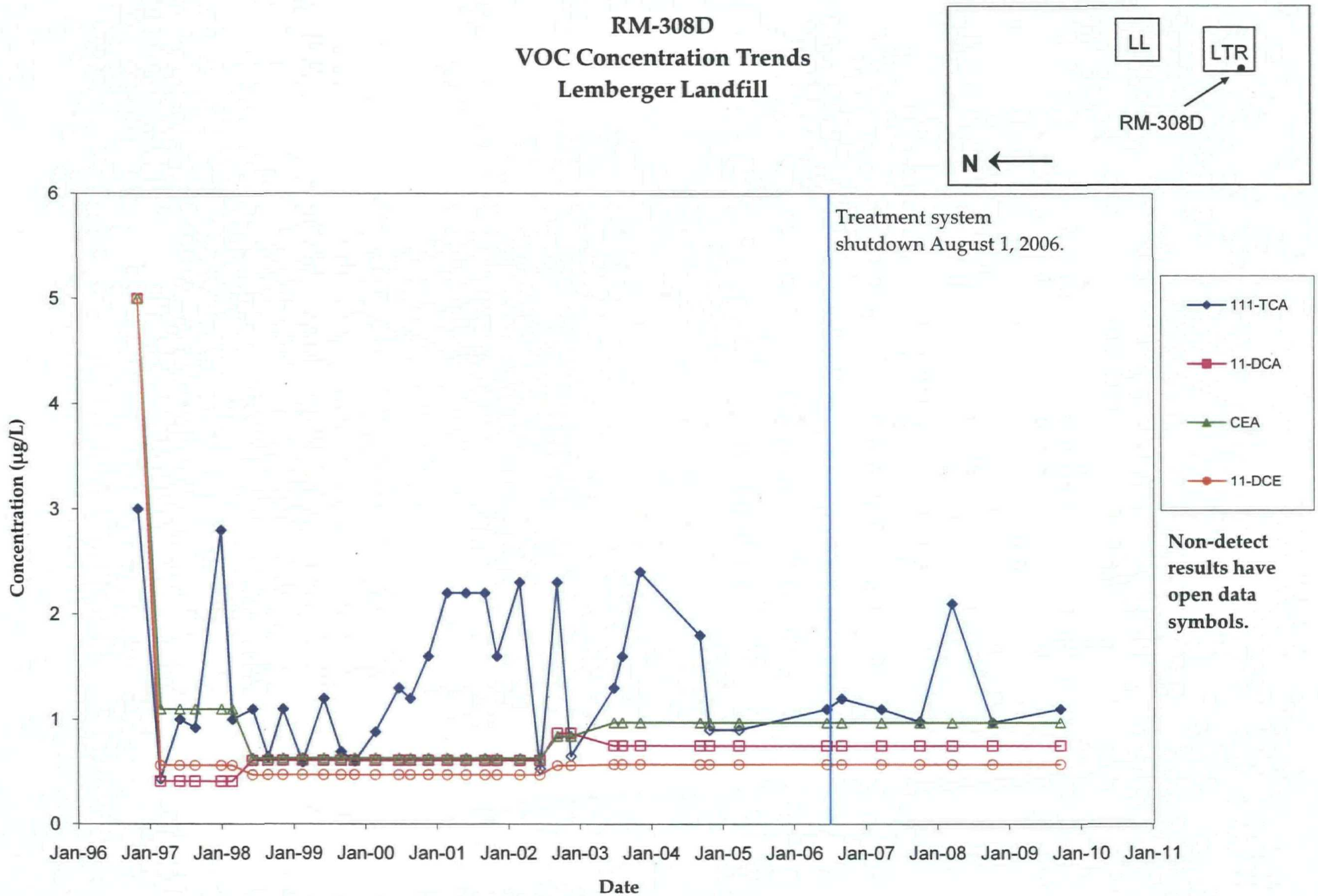
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ane TRENDS 02 2010.xlsm 4/5/2010



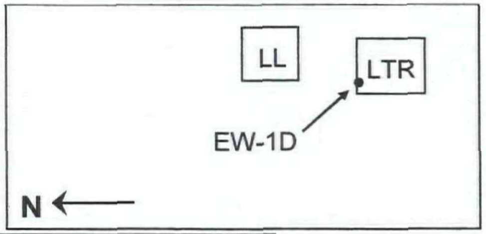
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ane TRENDS 02 2010.xlsm 4/5/2010

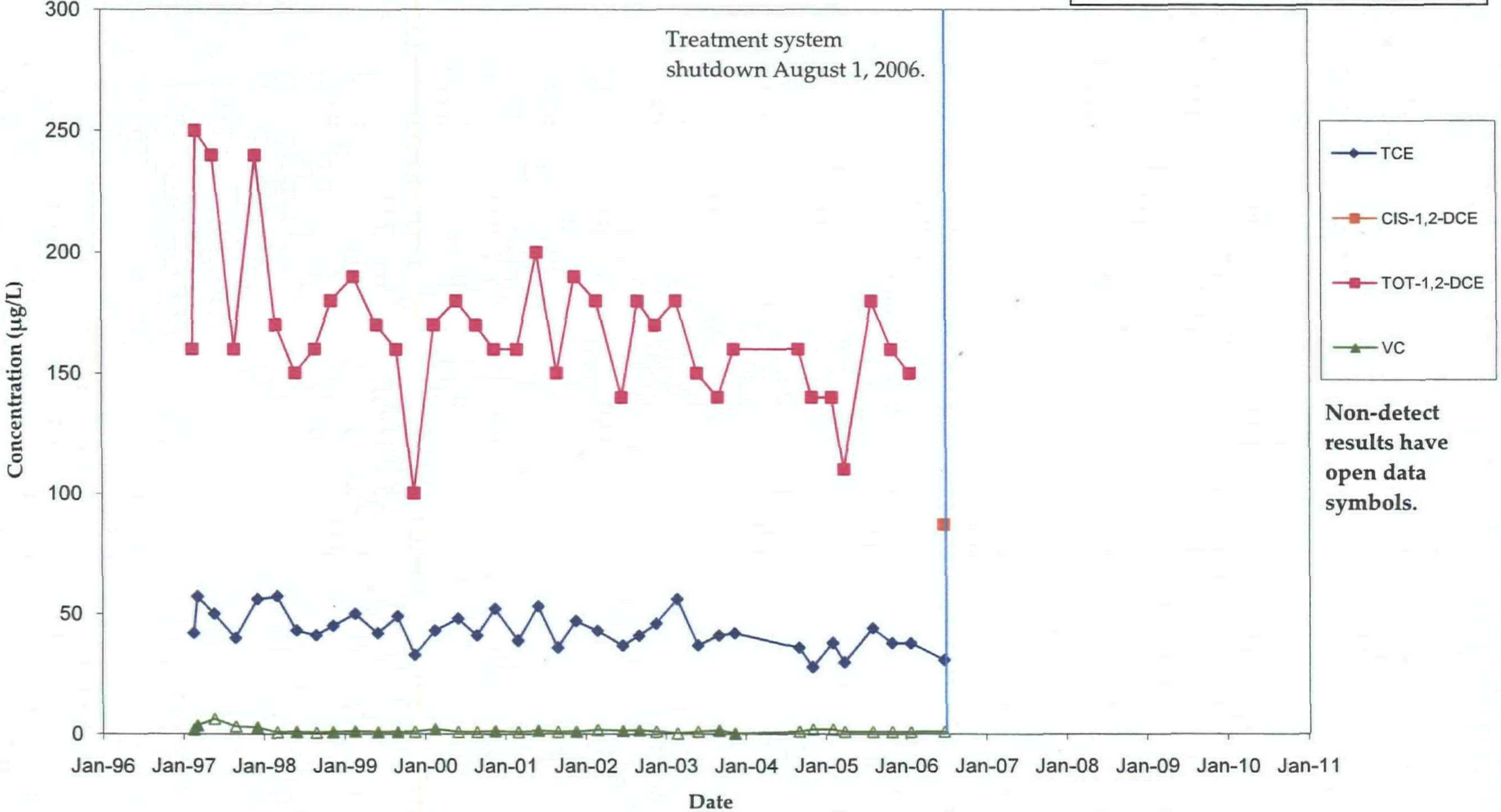

RM-307D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-307D
N
Treatment system shutdown August 1, 2006.
800
700
600
500
400
300
200
100
0
Concentration (µg/L)
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
111-TCA
11-DCA
CEA
11-DCE
Non-detect results have open data symbols.

RM-308D
VOC Concentration Trends
Lemberger Landfill

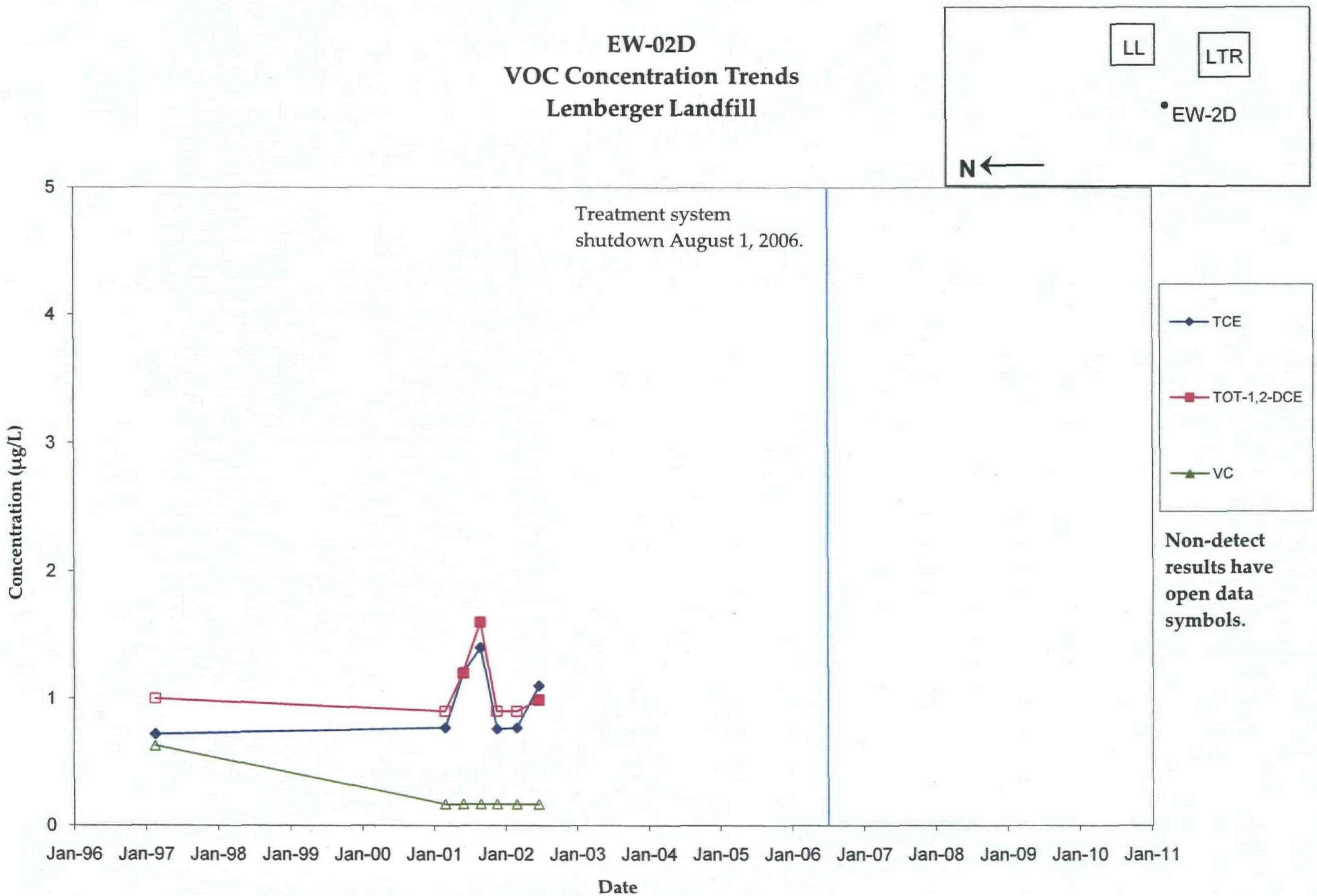


EW-01D
VOC Concentration Trends
Lemberger Landfill

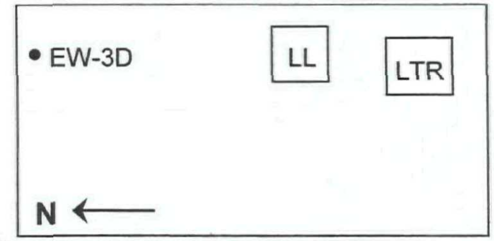


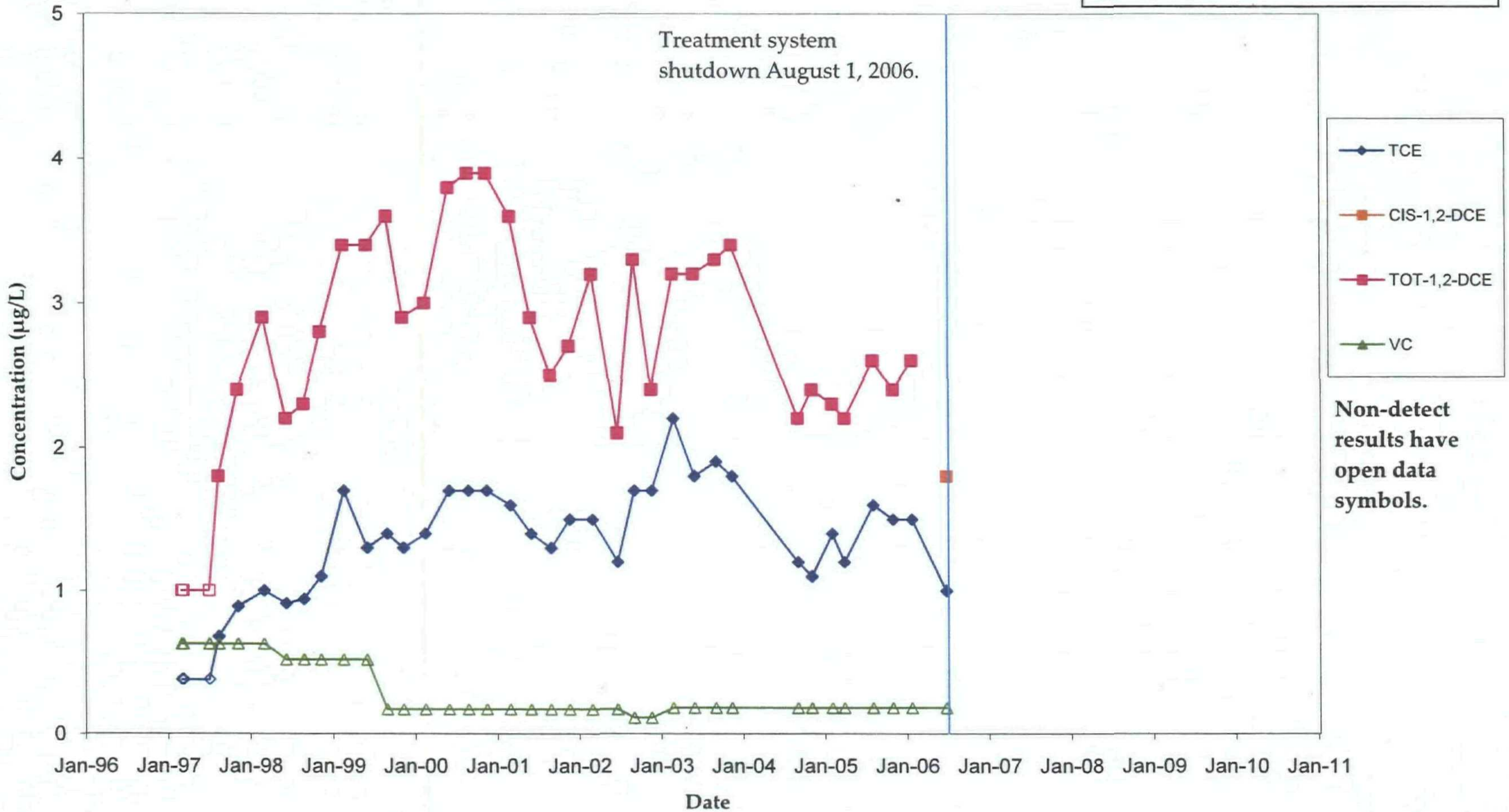


Non-detect results have open data symbols.


EW-02D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
EW-2D
N
Treatment system
shutdown August 1, 2006.
Concentration (µg/L)
0
1
2
3
4
5
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
TCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.

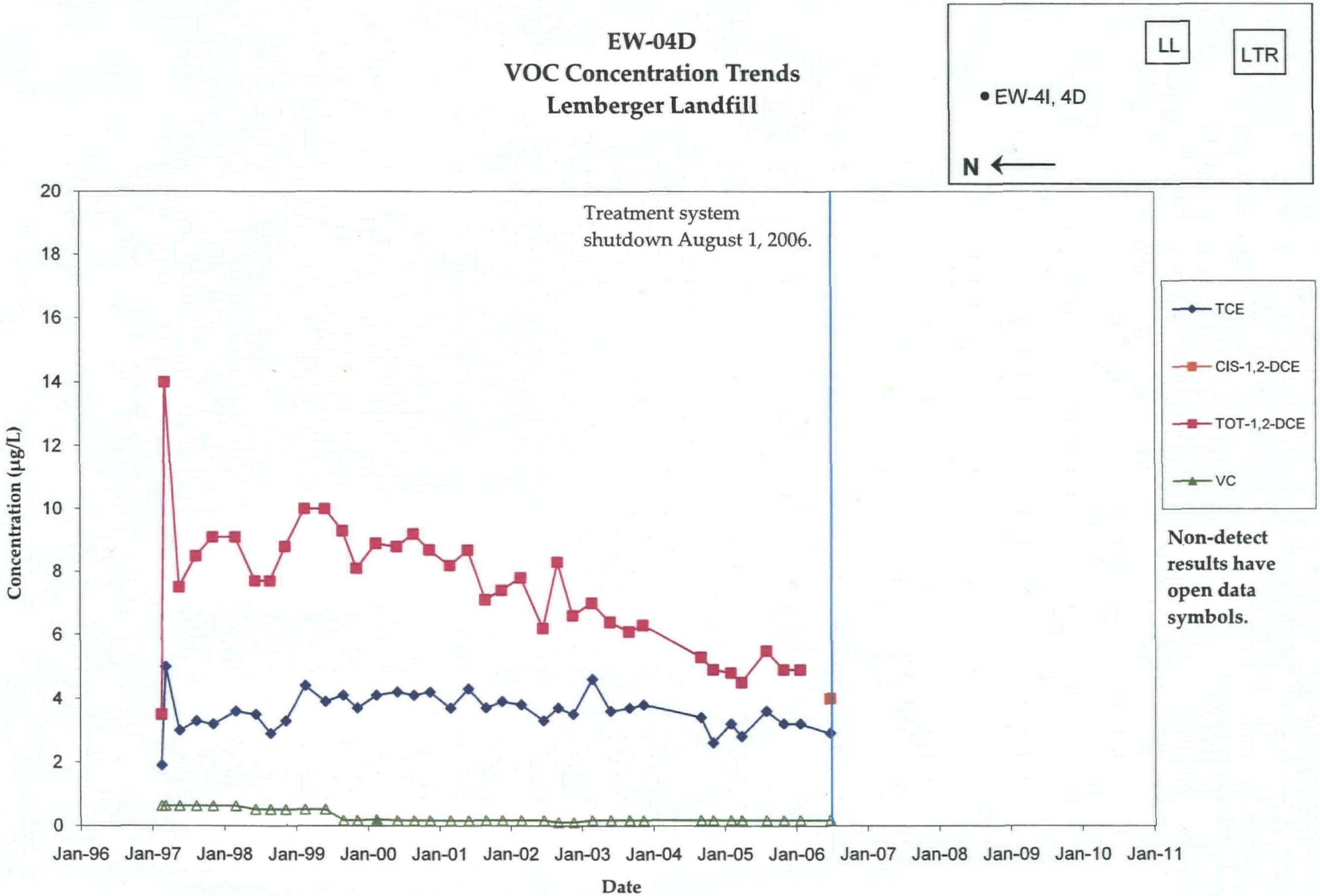
EW-03D
VOC Concentration Trends
Lemberger Landfill





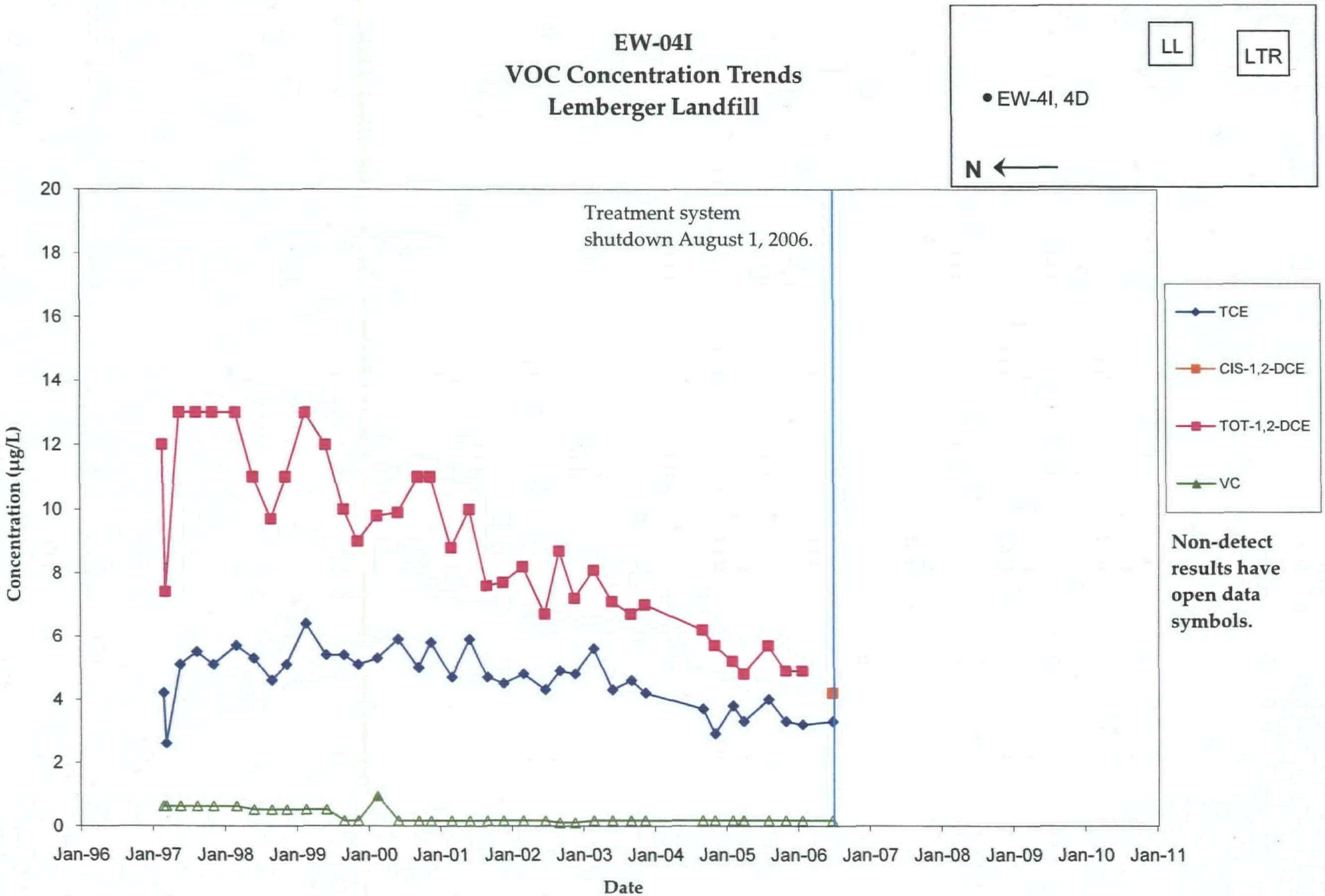
Non-detect results have open data symbols.

EW-04D
VOC Concentration Trends
Lemberger Landfill



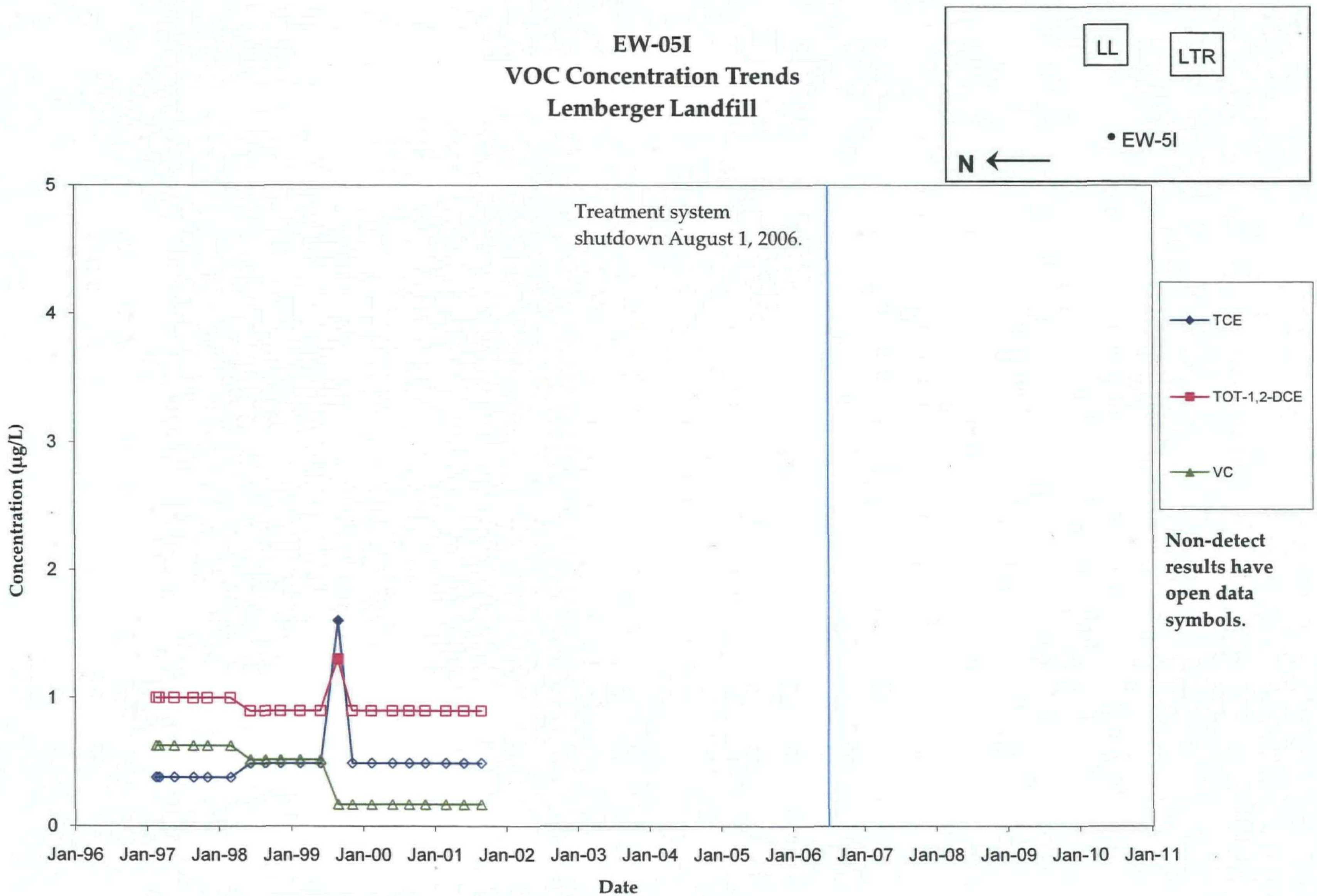
Non-detect results have open data symbols.

EW-04I
VOC Concentration Trends
Lemberger Landfill

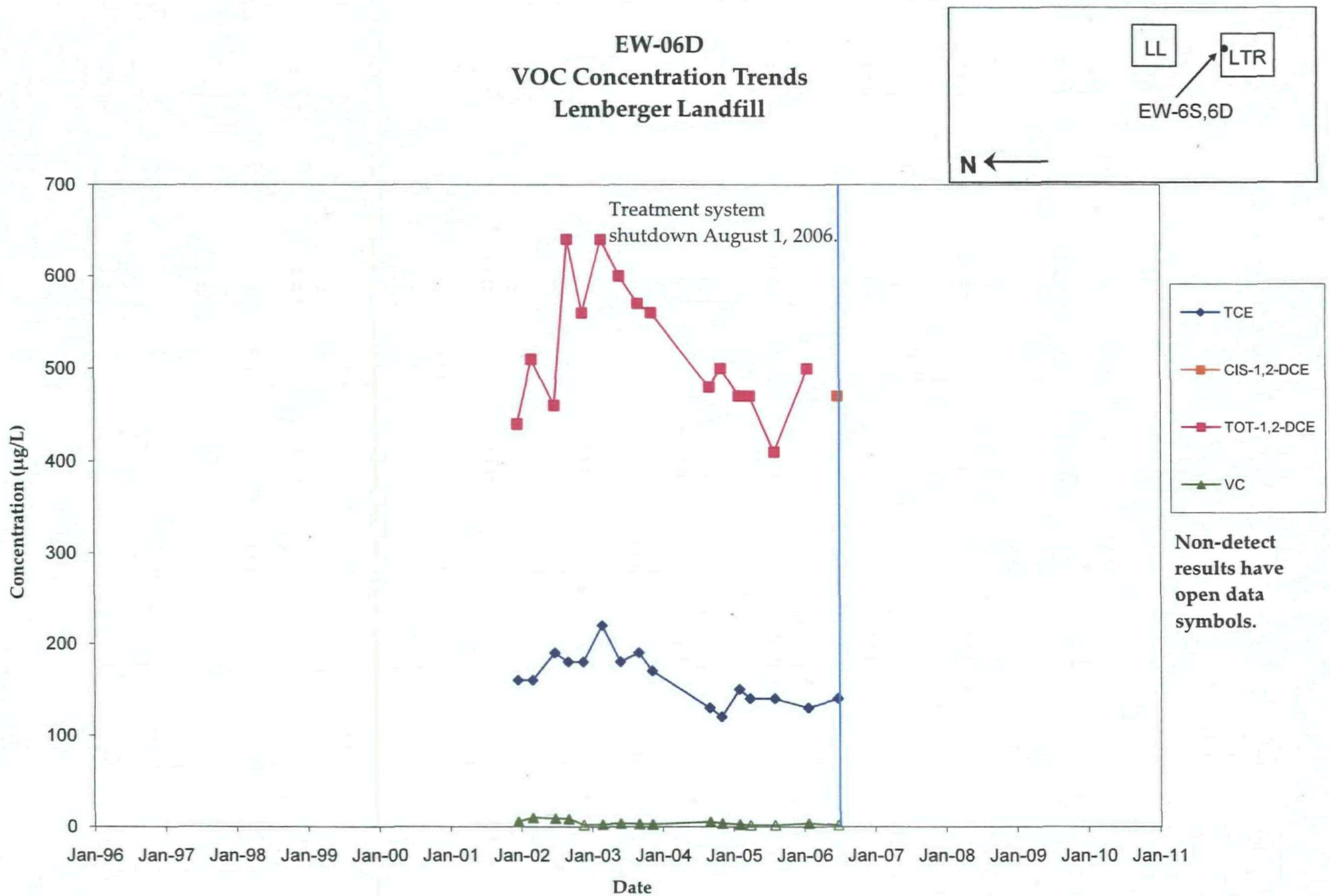


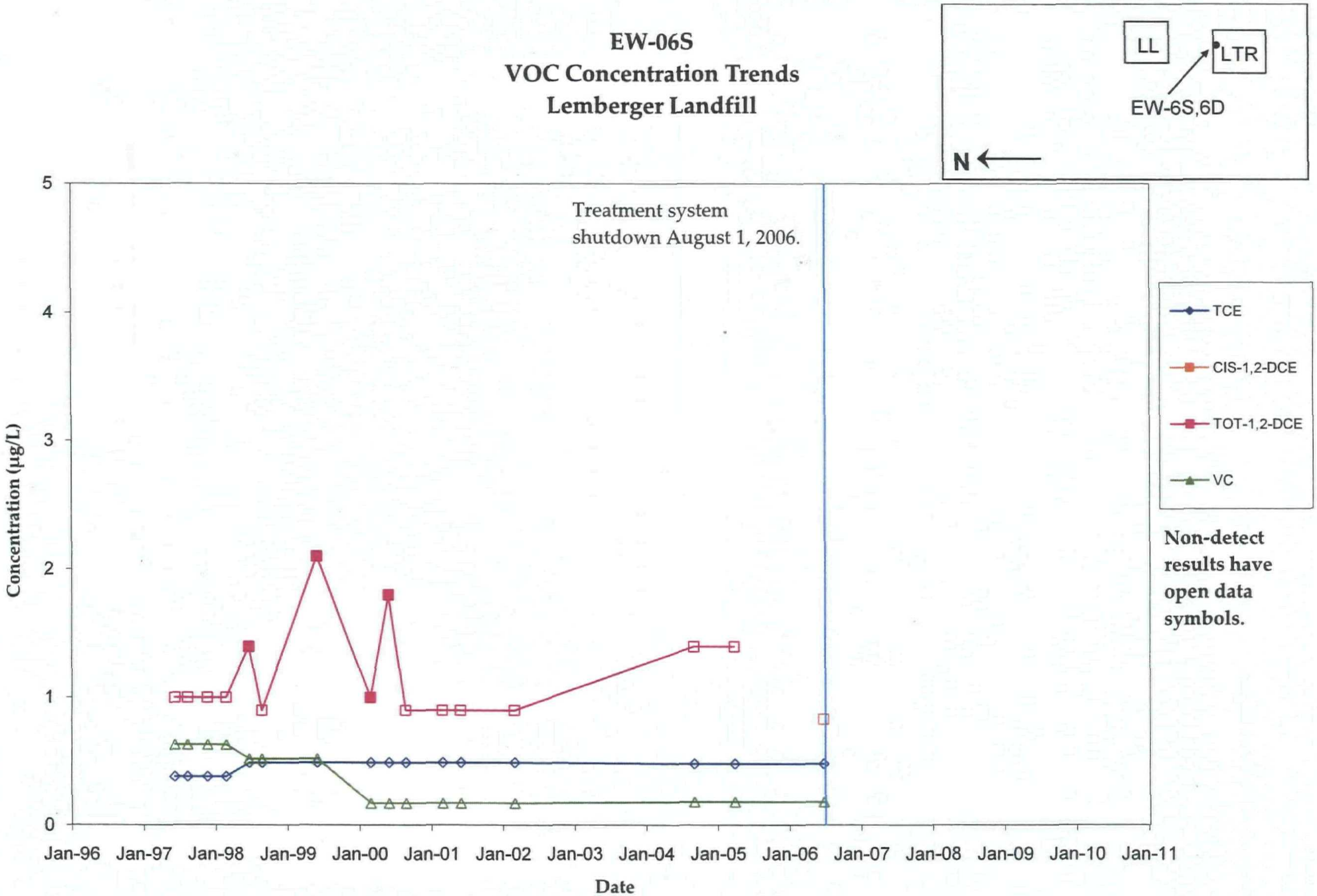
Non-detect results have open data symbols.

EW-05I
VOC Concentration Trends
Lemberger Landfill

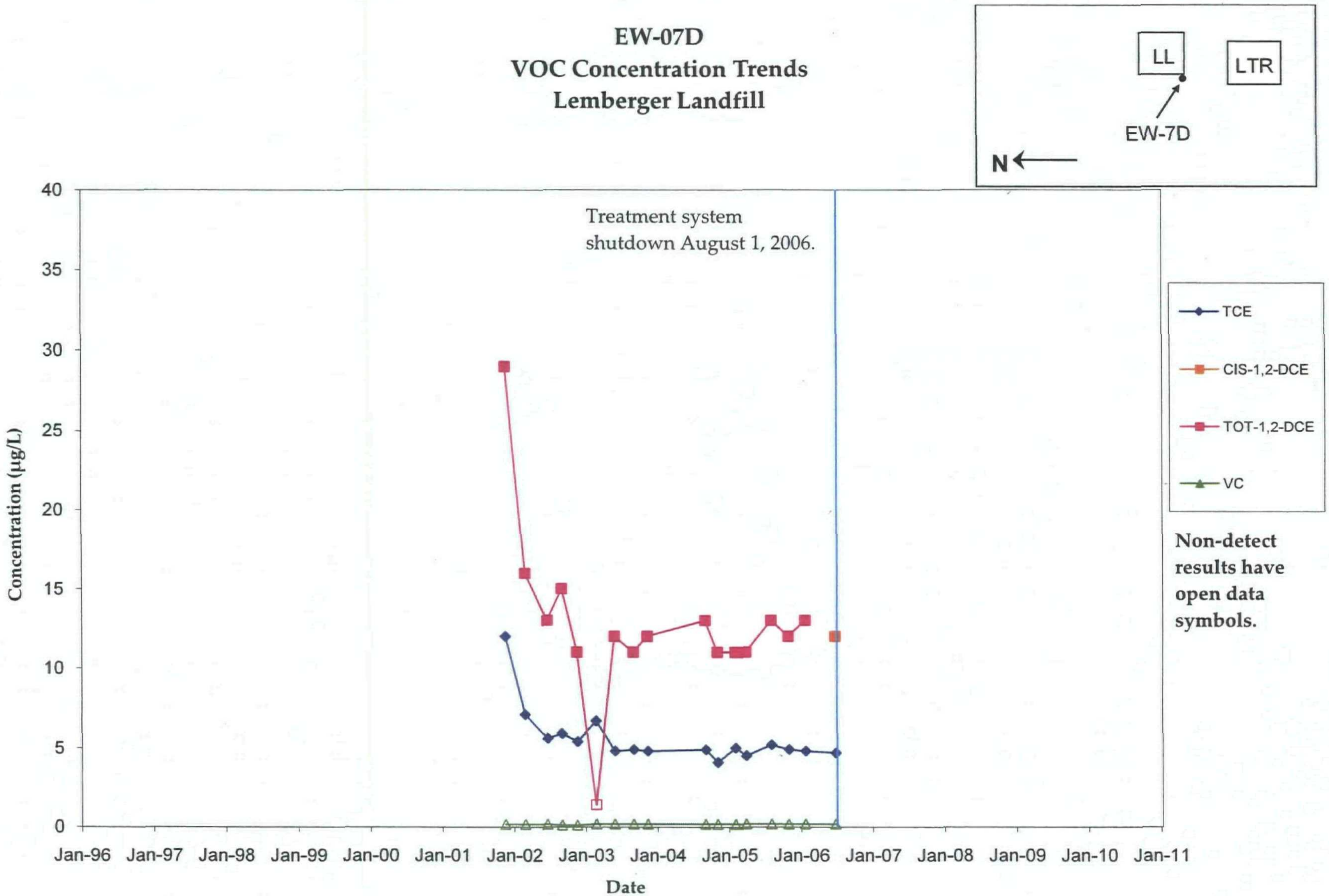


Non-detect results have open data symbols.


EW-06D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
EW-6S,6D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
700
600
500
400
300
200
100
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.

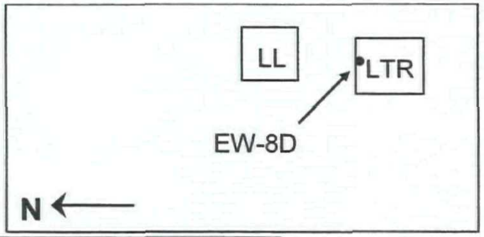

EW-06S
VOC Concentration Trends
Lemberger Landfill
LL
LTR
EW-6S,6D
N
Treatment system
shutdown August 1, 2006.
Concentration (µg/L)
0
1
2
3
4
5
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect
results have
open data
symbols.

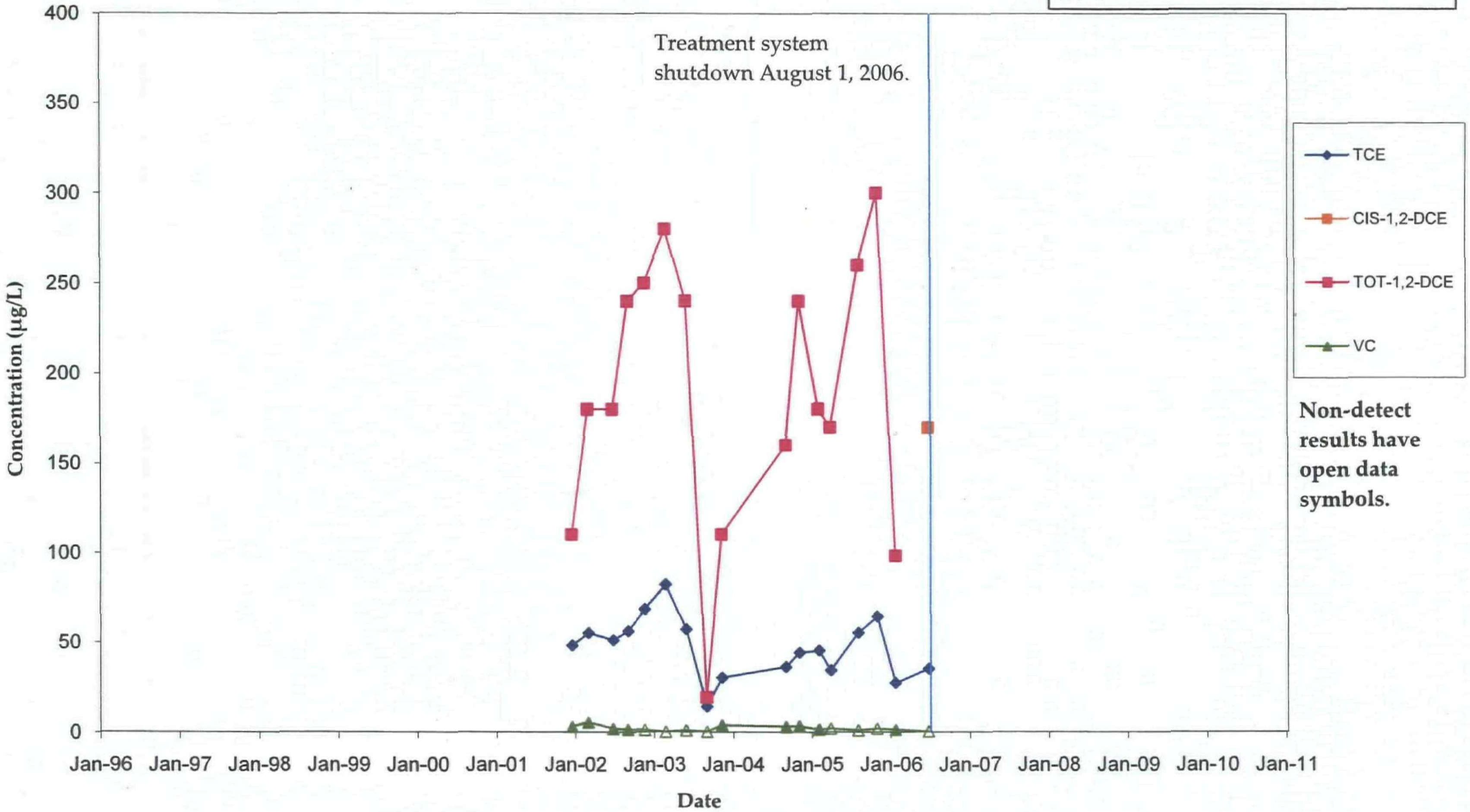
EW-07D
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.

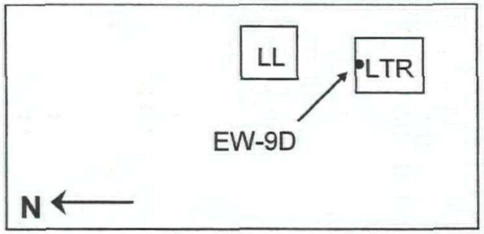
**EW-08D
VOC Concentration Trends
Lemberger Landfill**

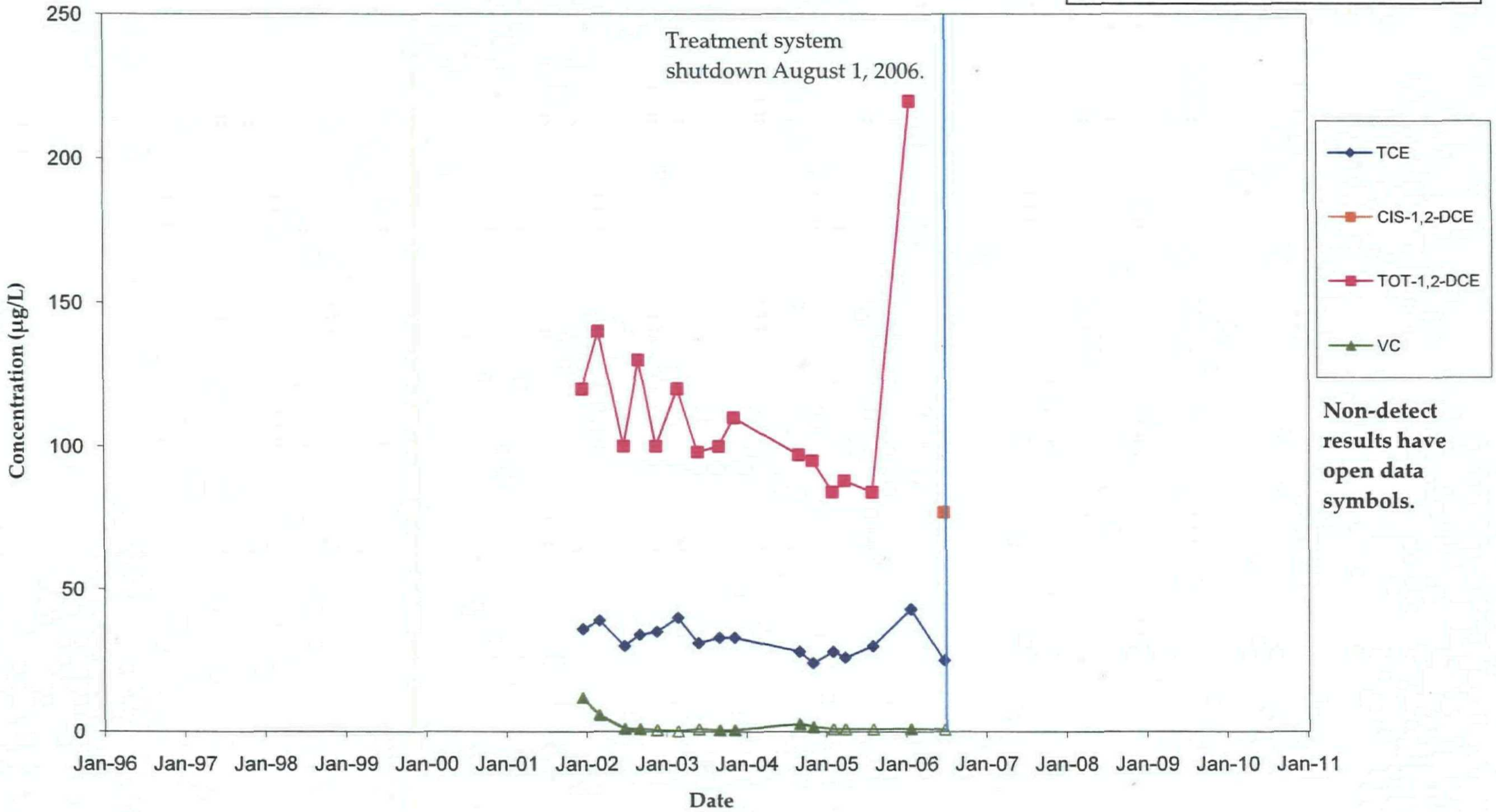




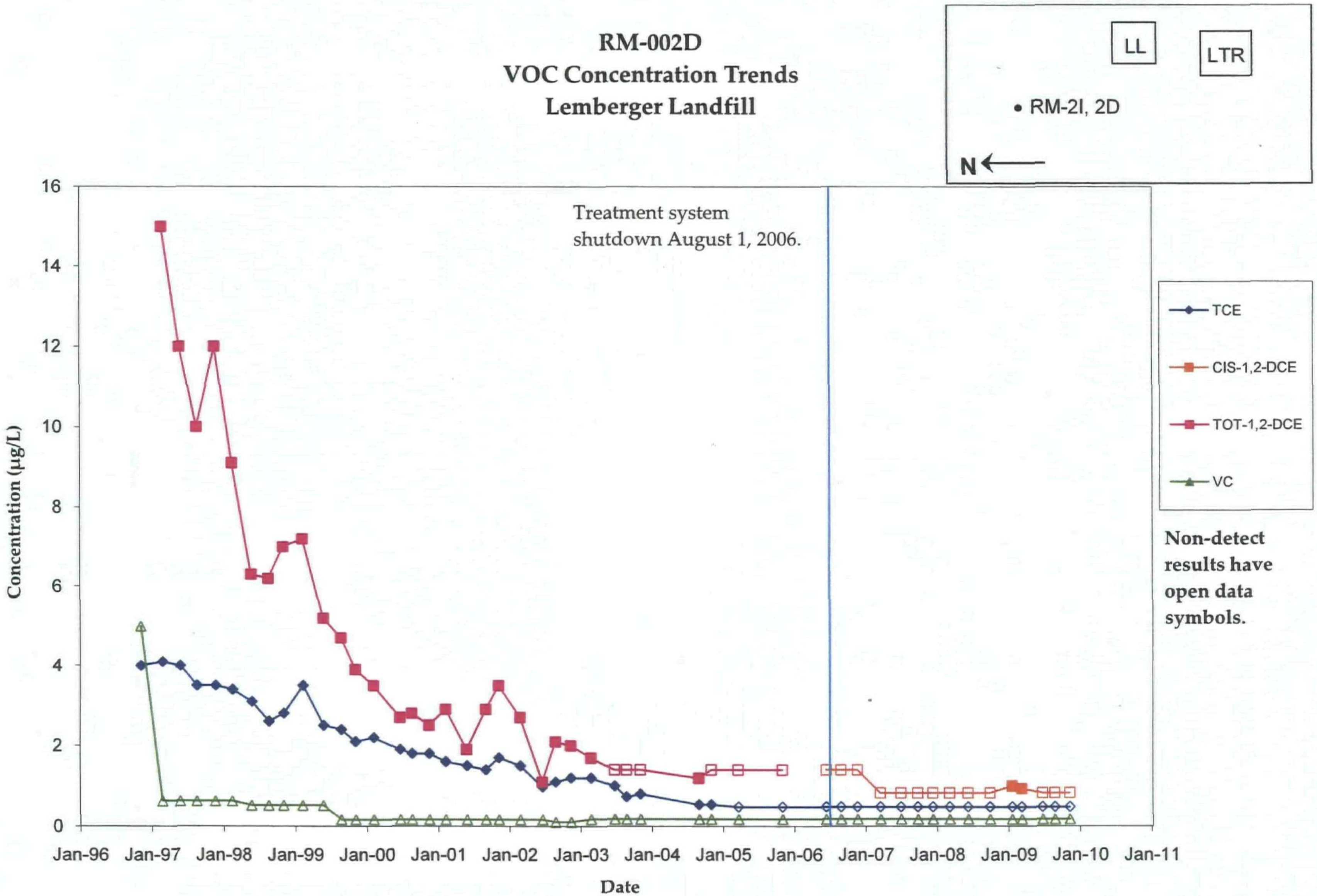
Non-detect results have open data symbols.

EW-09D
VOC Concentration Trends
Lemberger Landfill





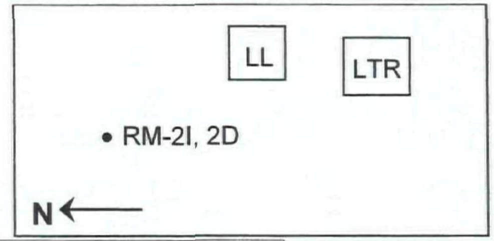
Non-detect results have open data symbols.

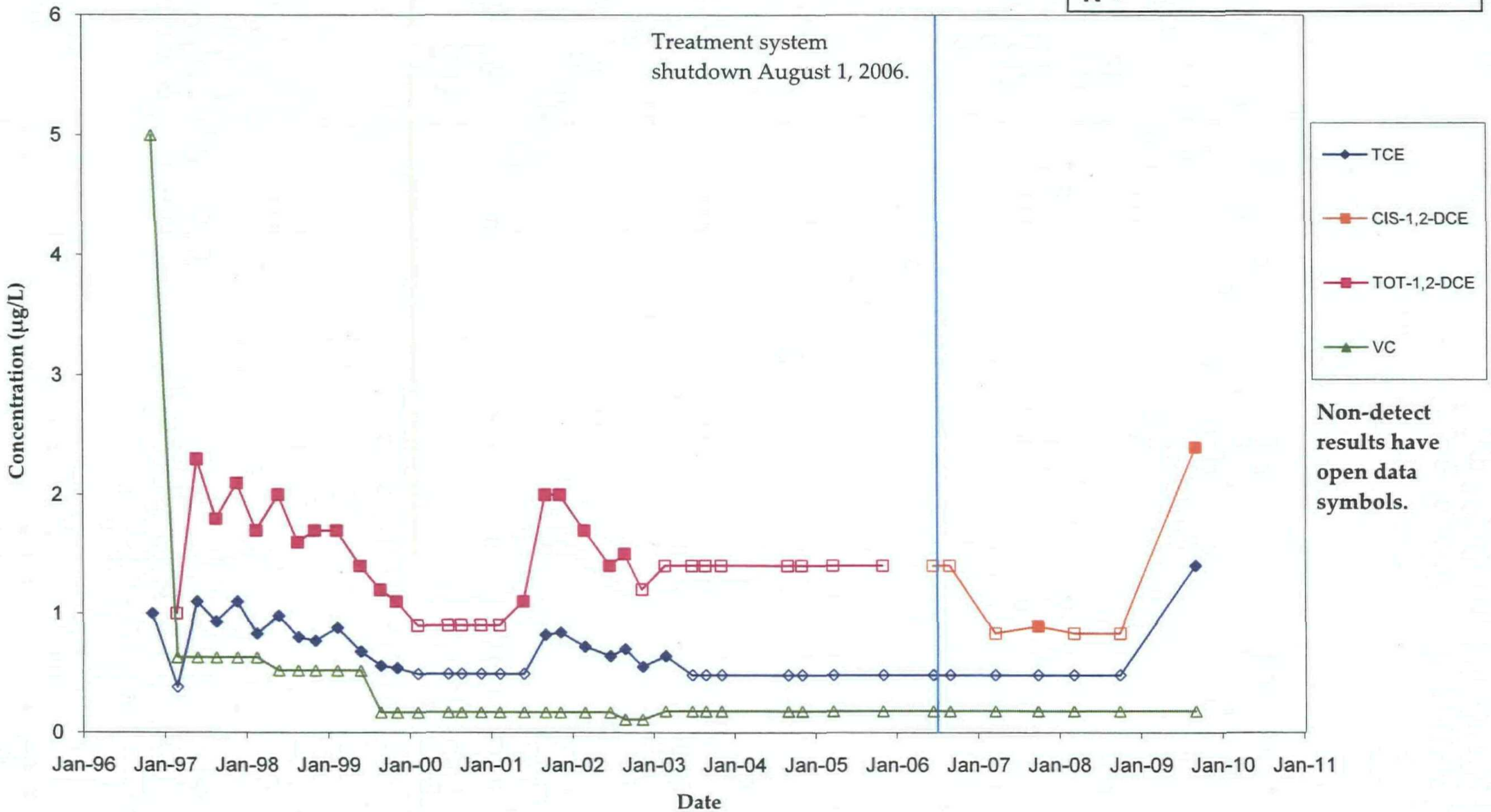


Non-detect results have open data symbols.

Exhibit 27
Page 67 of 108

RM-002I
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

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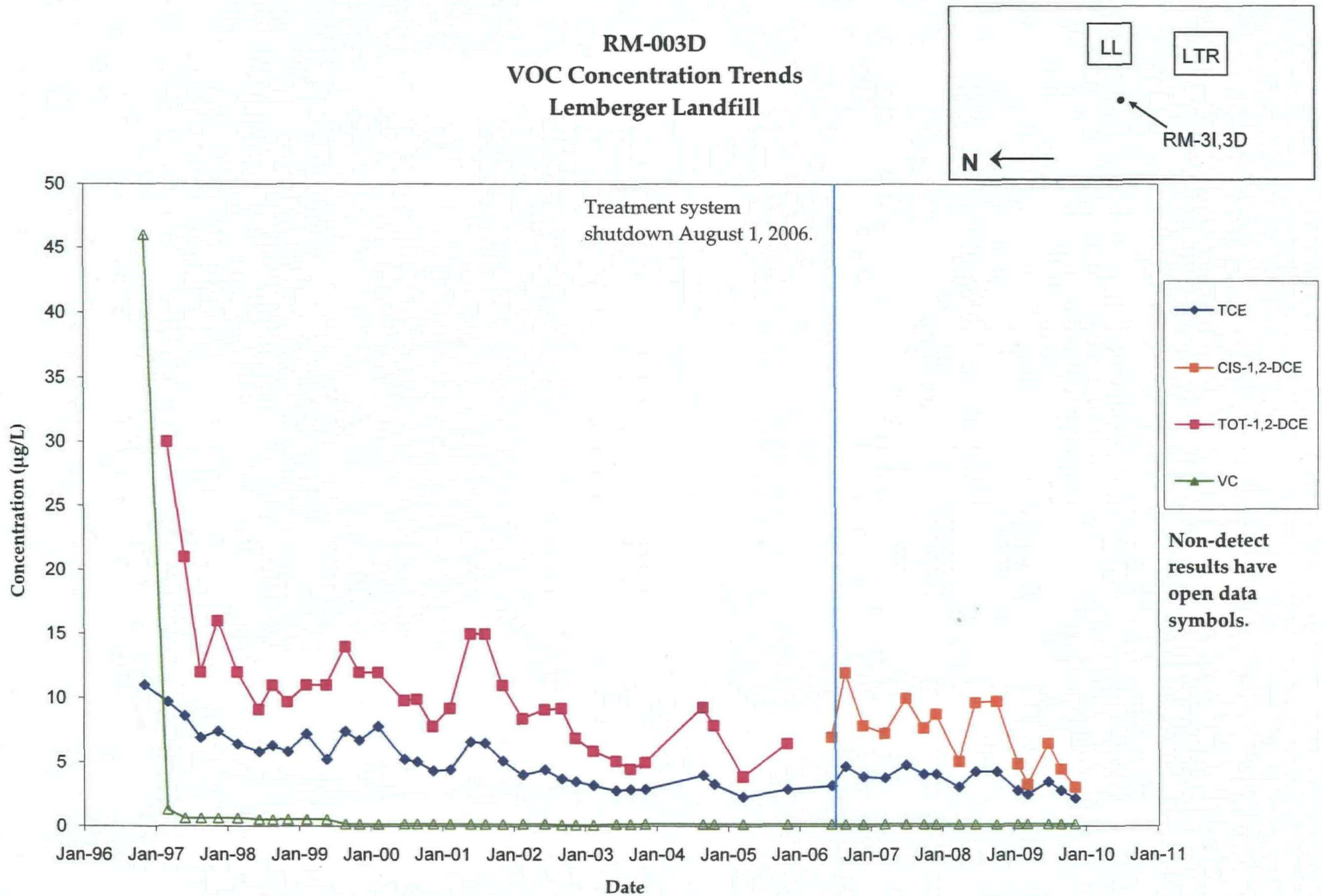
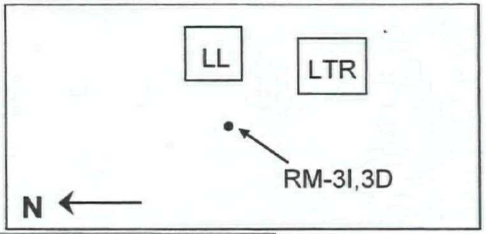
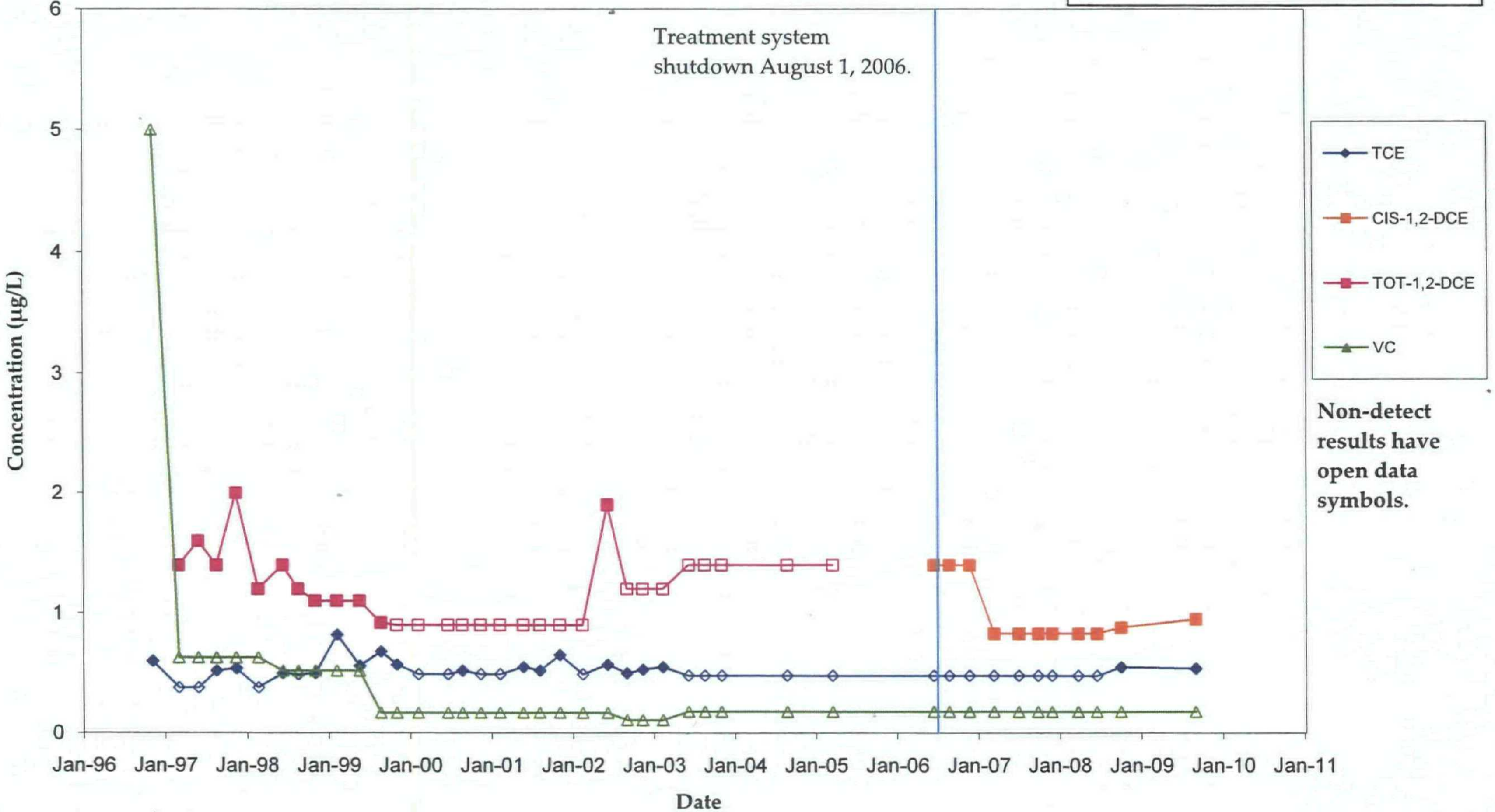


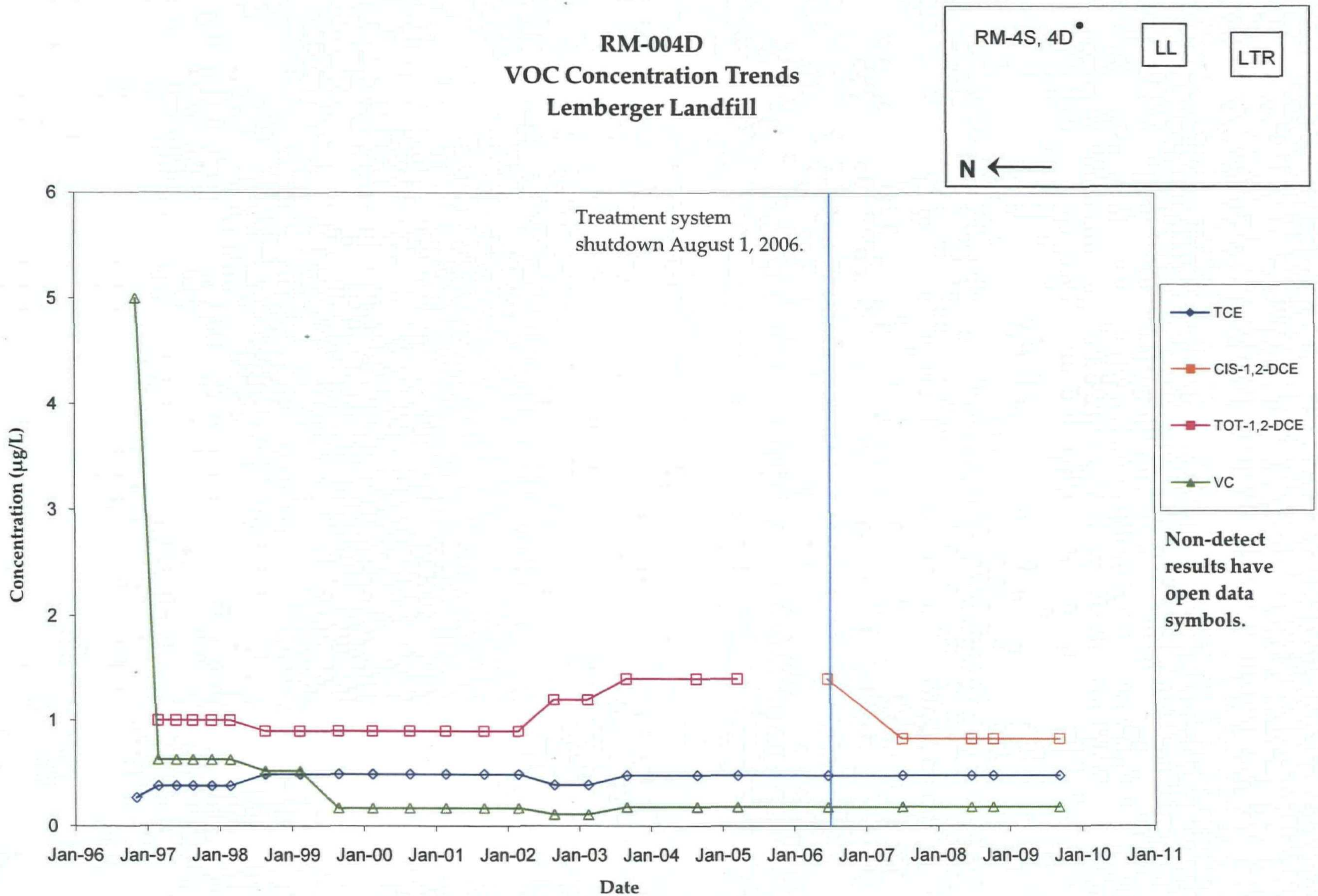
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010

RM-003I
VOC Concentration Trends
Lemberger Landfill

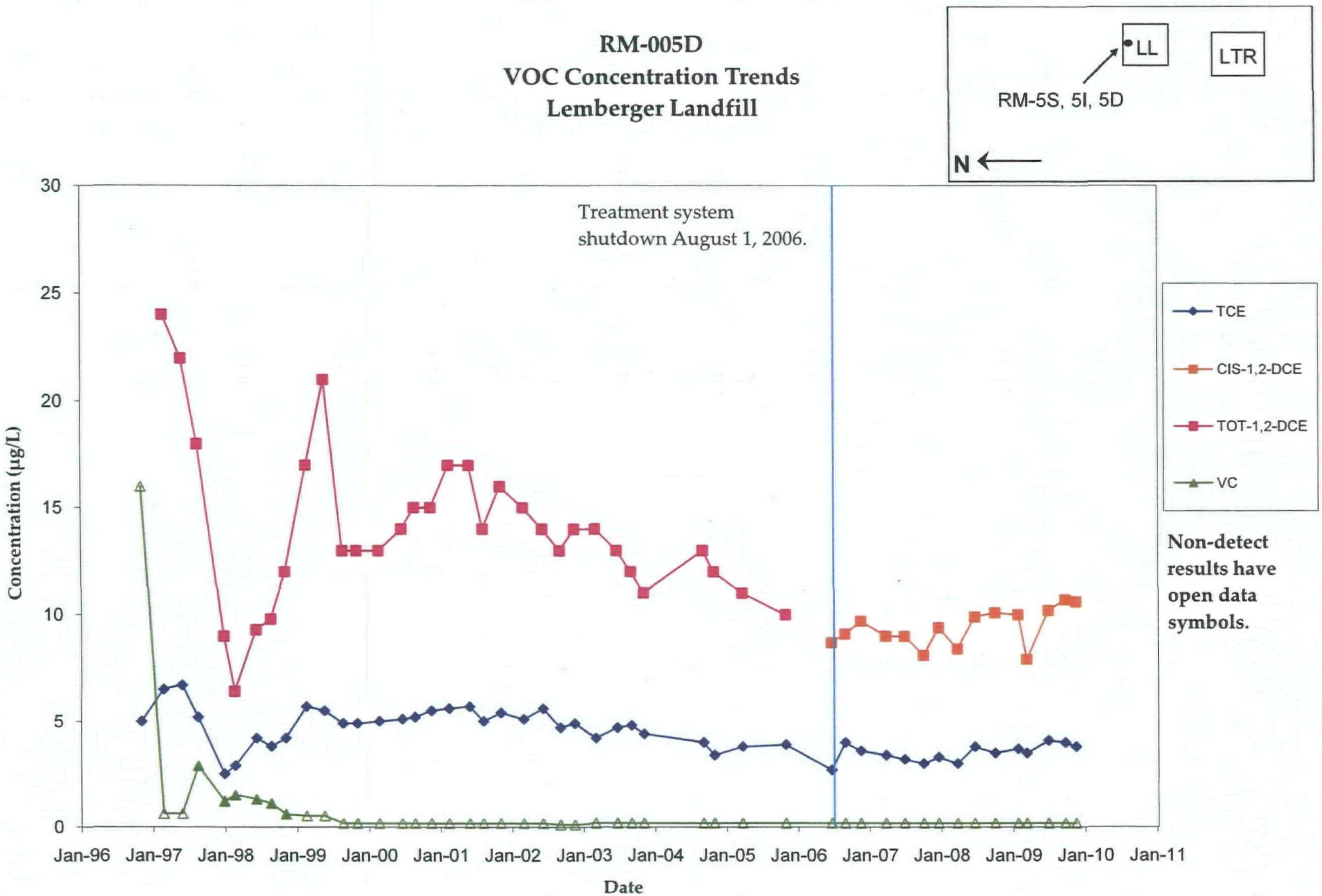




Non-detect results have open data symbols.

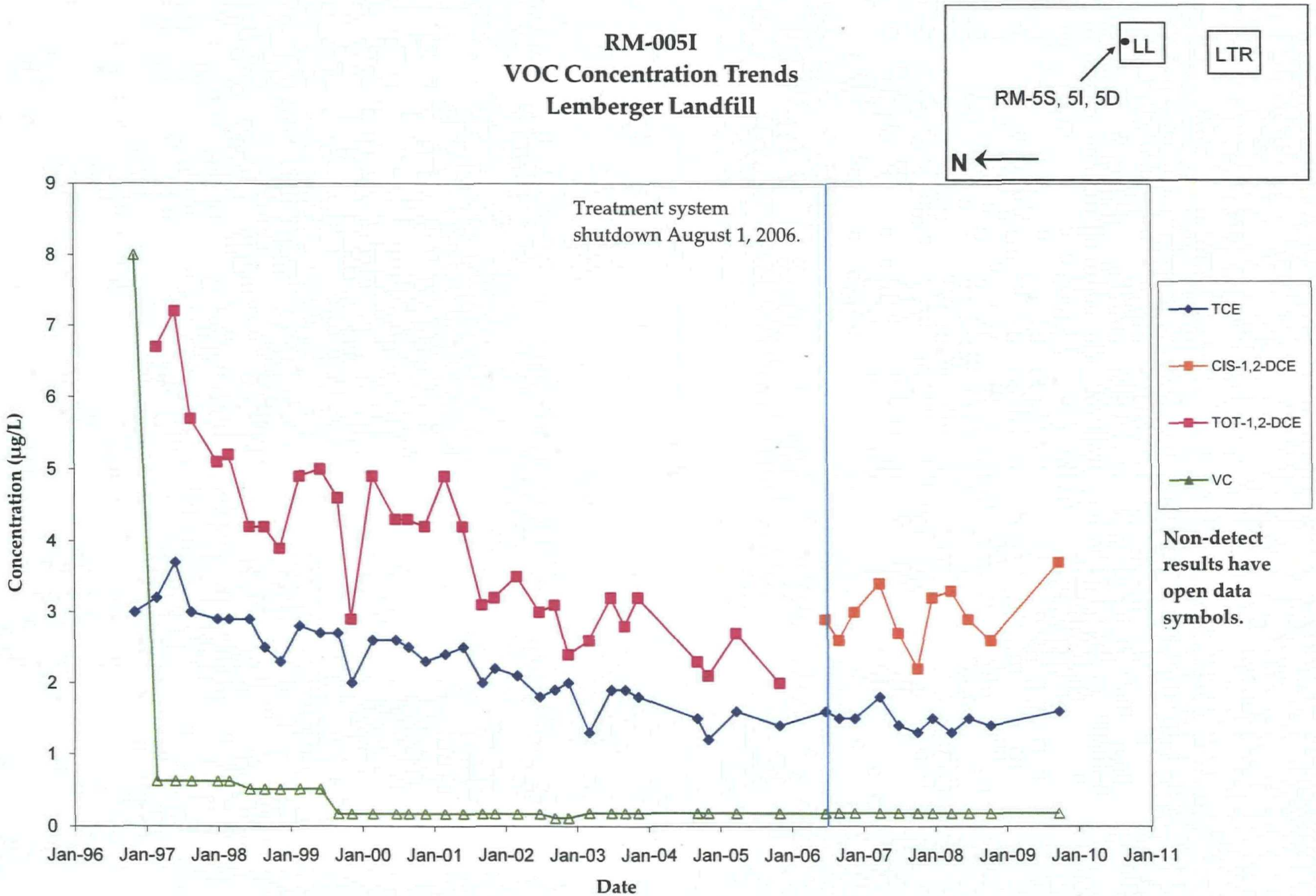

RM-004D
VOC Concentration Trends
Lemberger Landfill
RM-4S, 4D
LL
LTR
N
Treatment system
shutdown August 1, 2006.
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect
results have
open data
symbols.
Concentration (µg/L)
0
1
2
3
4
5
6
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date

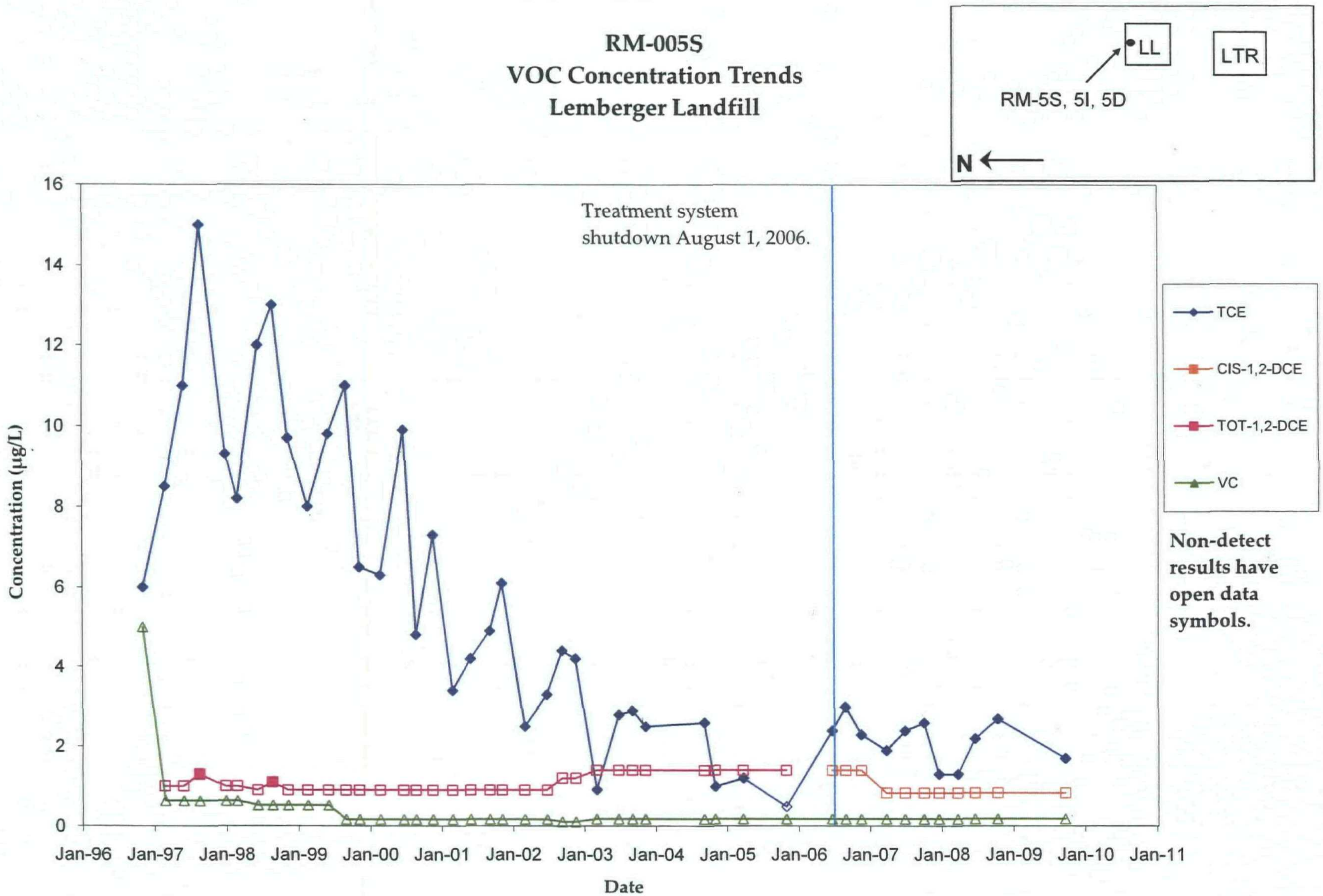
RM-005D
VOC Concentration Trends
Lemberger Landfill



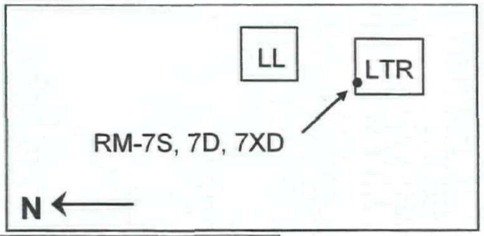
Non-detect results have open data symbols.

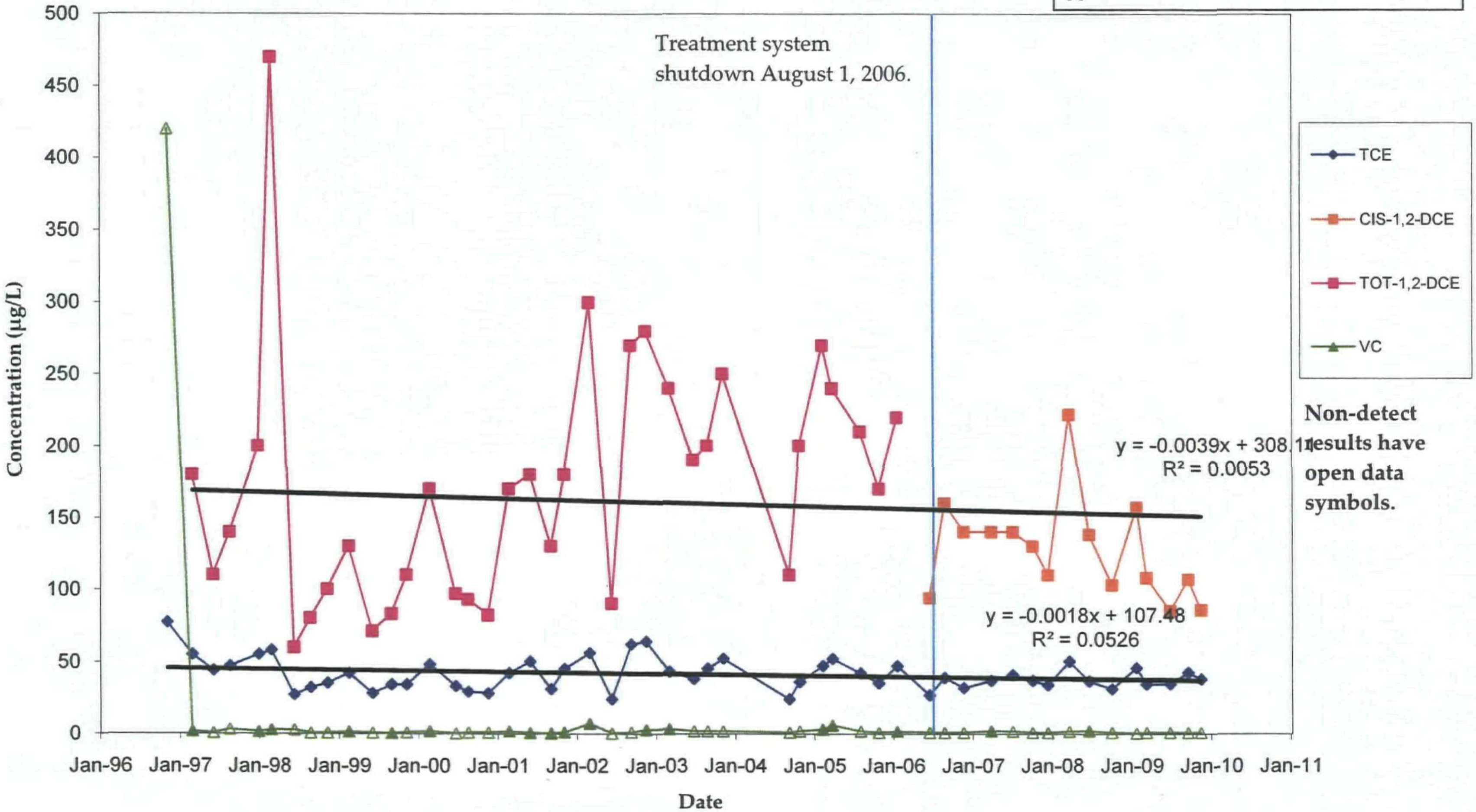
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010


RM-005I
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-5S, 5I, 5D
N
Treatment system
shutdown August 1, 2006.
Concentration (µg/L)
0
1
2
3
4
5
6
7
8
9
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect
results have
open data
symbols.


RM-005S
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-5S, 5I, 5D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
16
14
12
10
8
6
4
2
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.

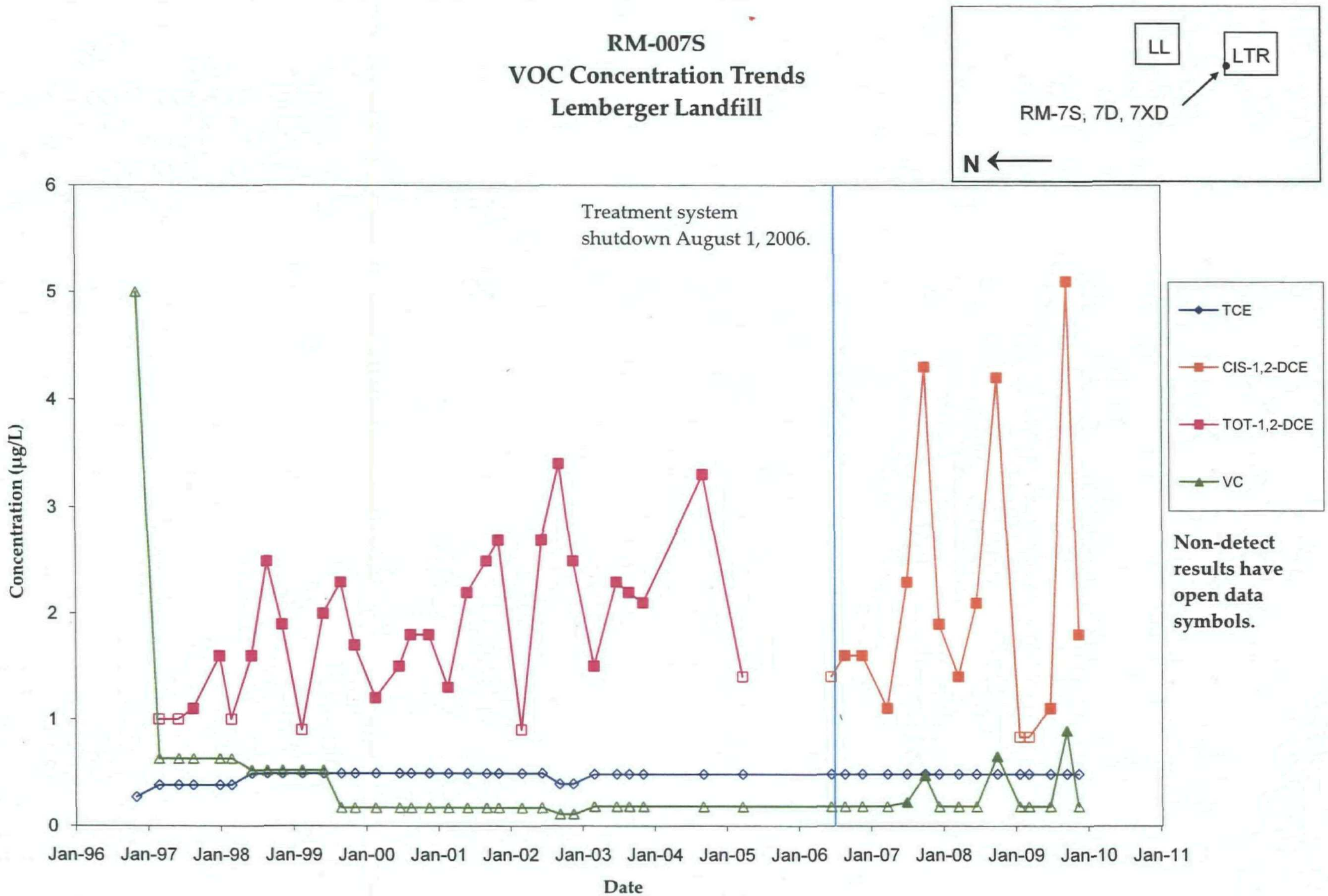
RM-007D
VOC Concentration Trends
Lemberger Landfill





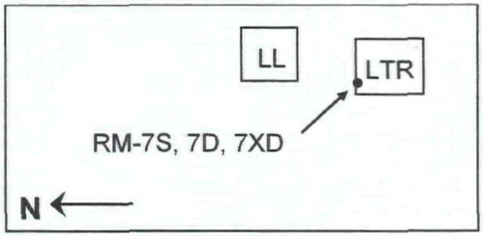
Non-detect results have open data symbols.

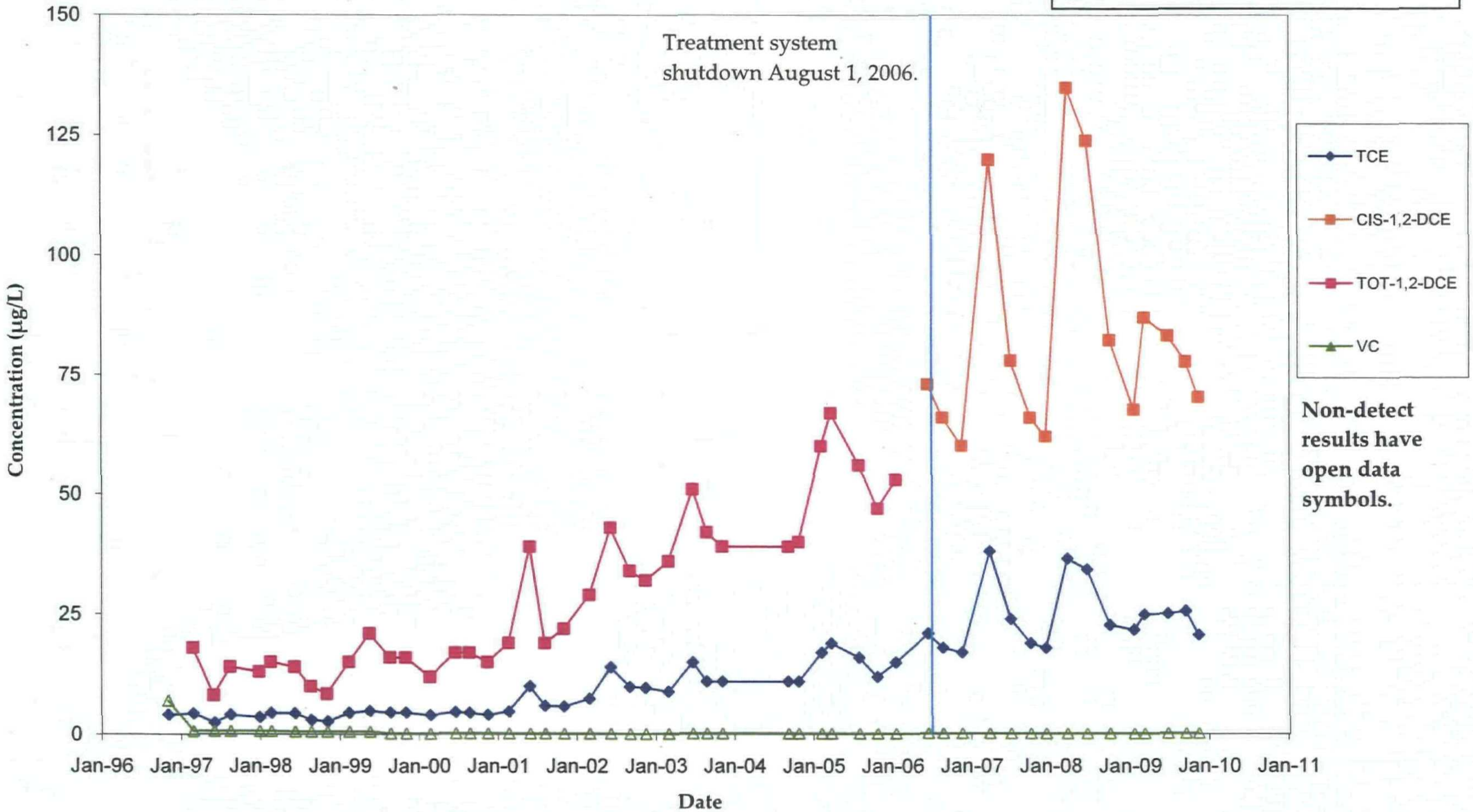
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010



Non-detect results have open data symbols.

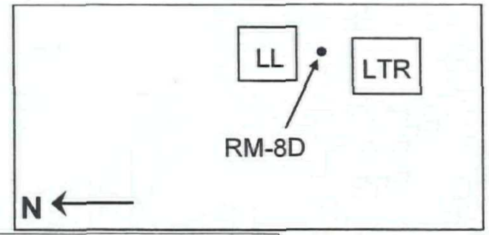
RM-007XD
VOC Concentration Trends
Lemberger Landfill

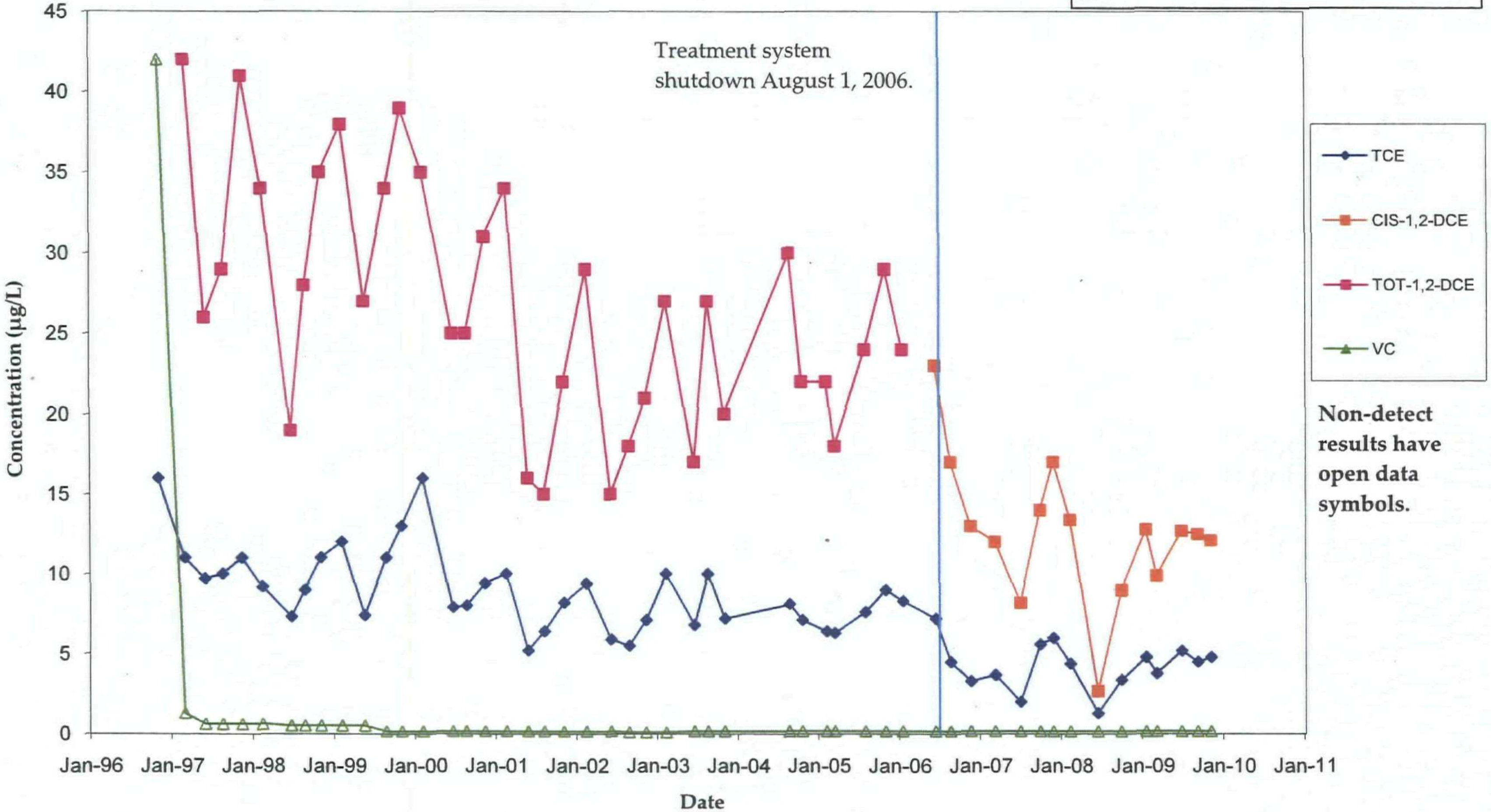




Non-detect results have open data symbols.

RM-008D
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

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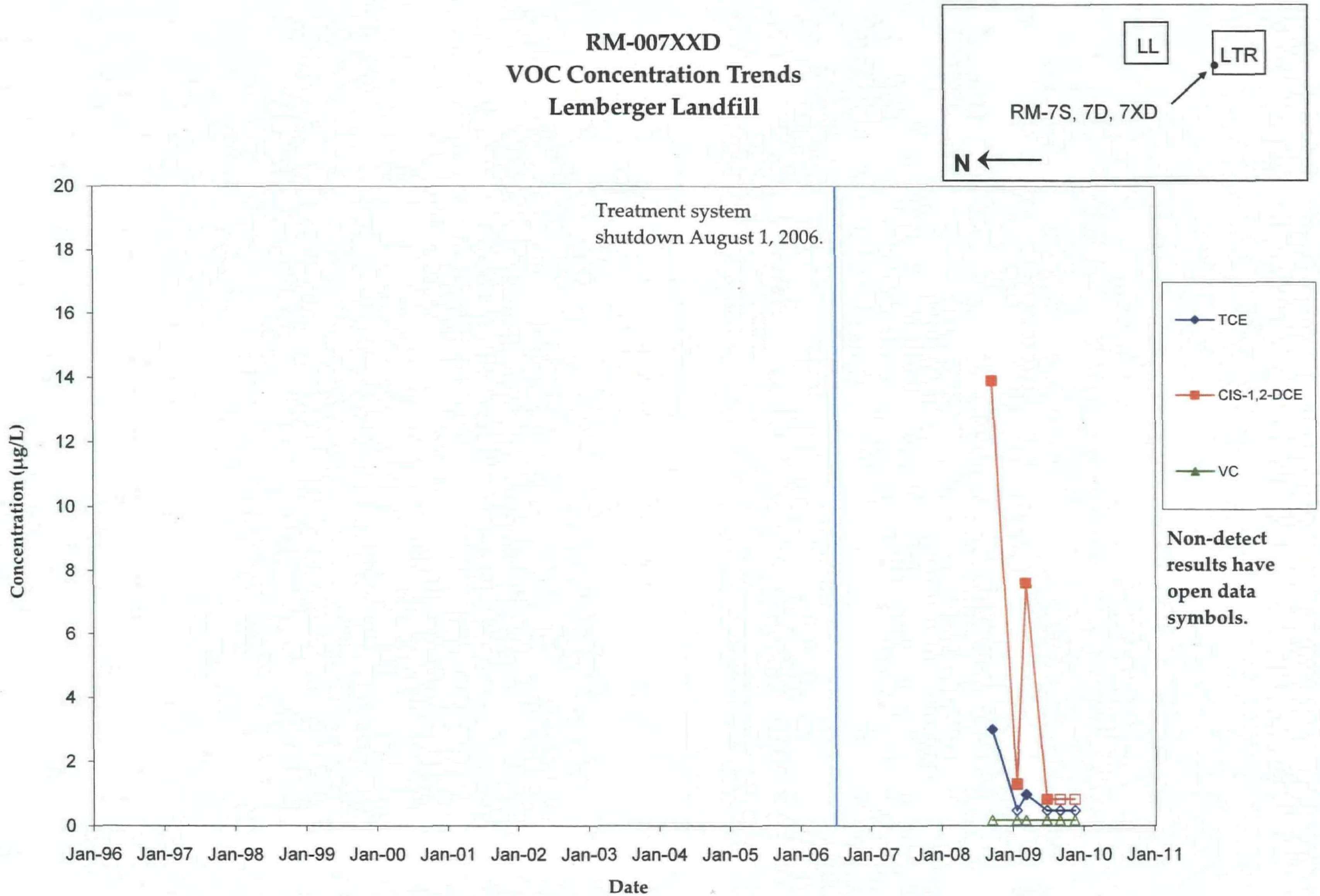
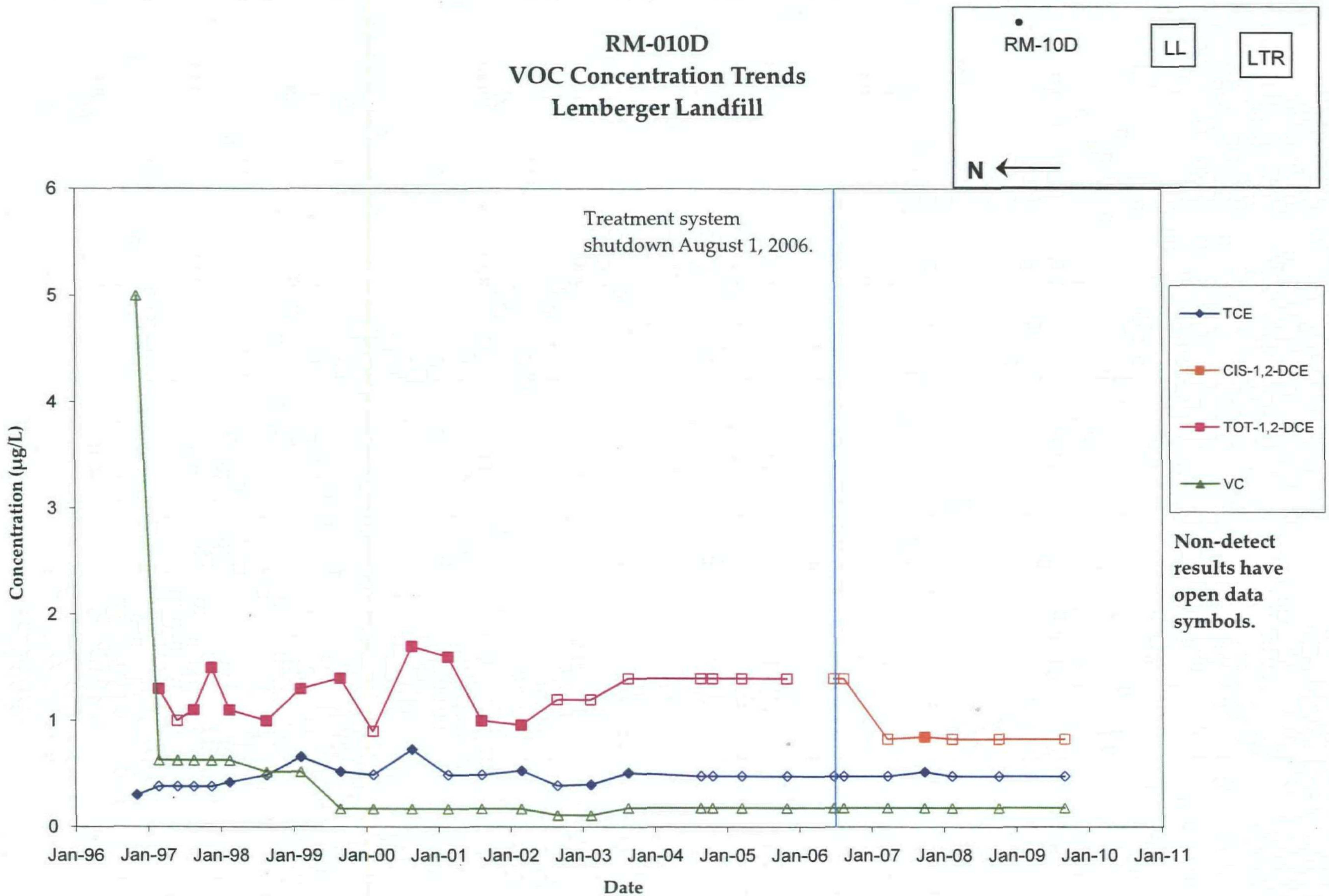
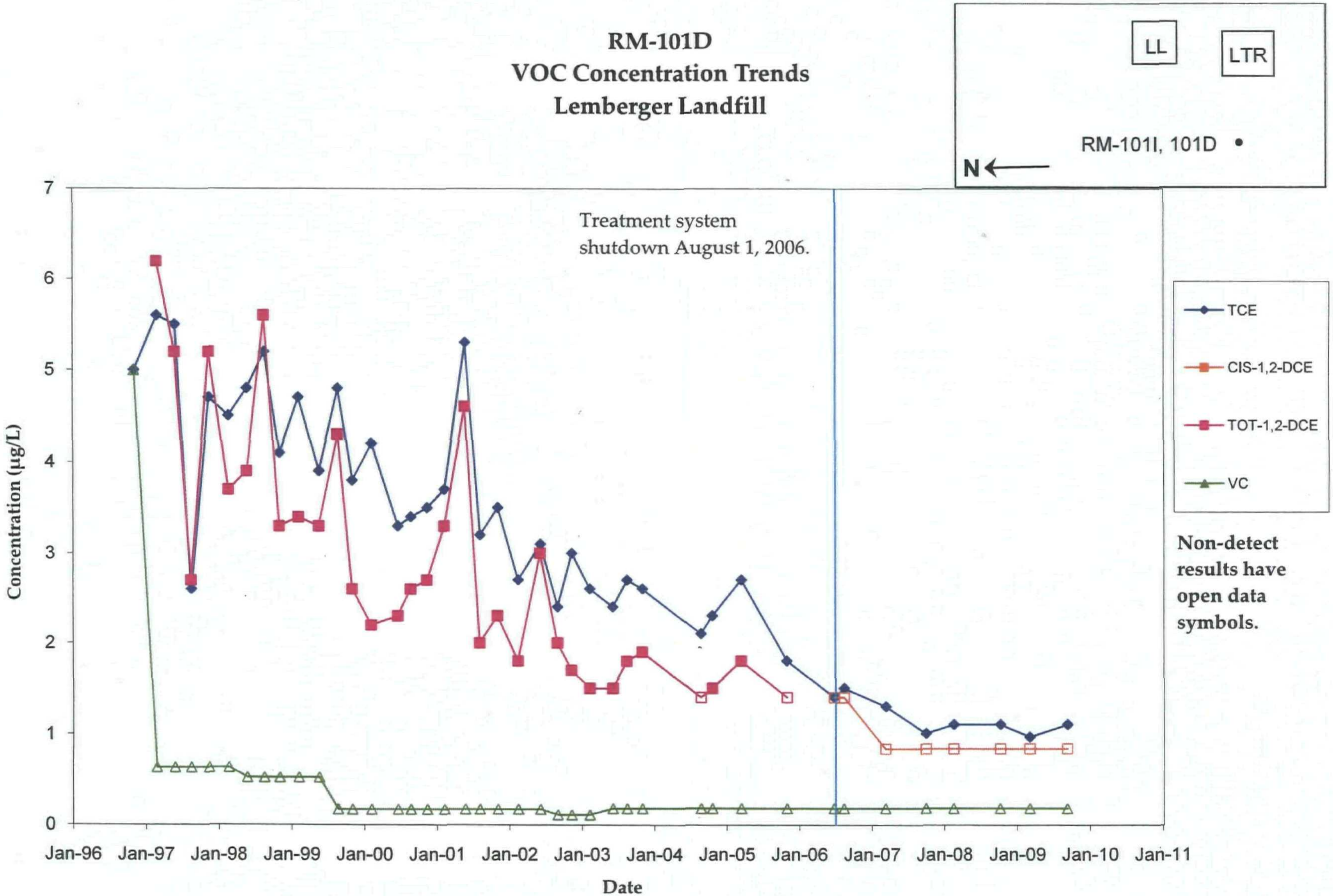
RM-007XXD
VOC Concentration Trends
Lemberger Landfill

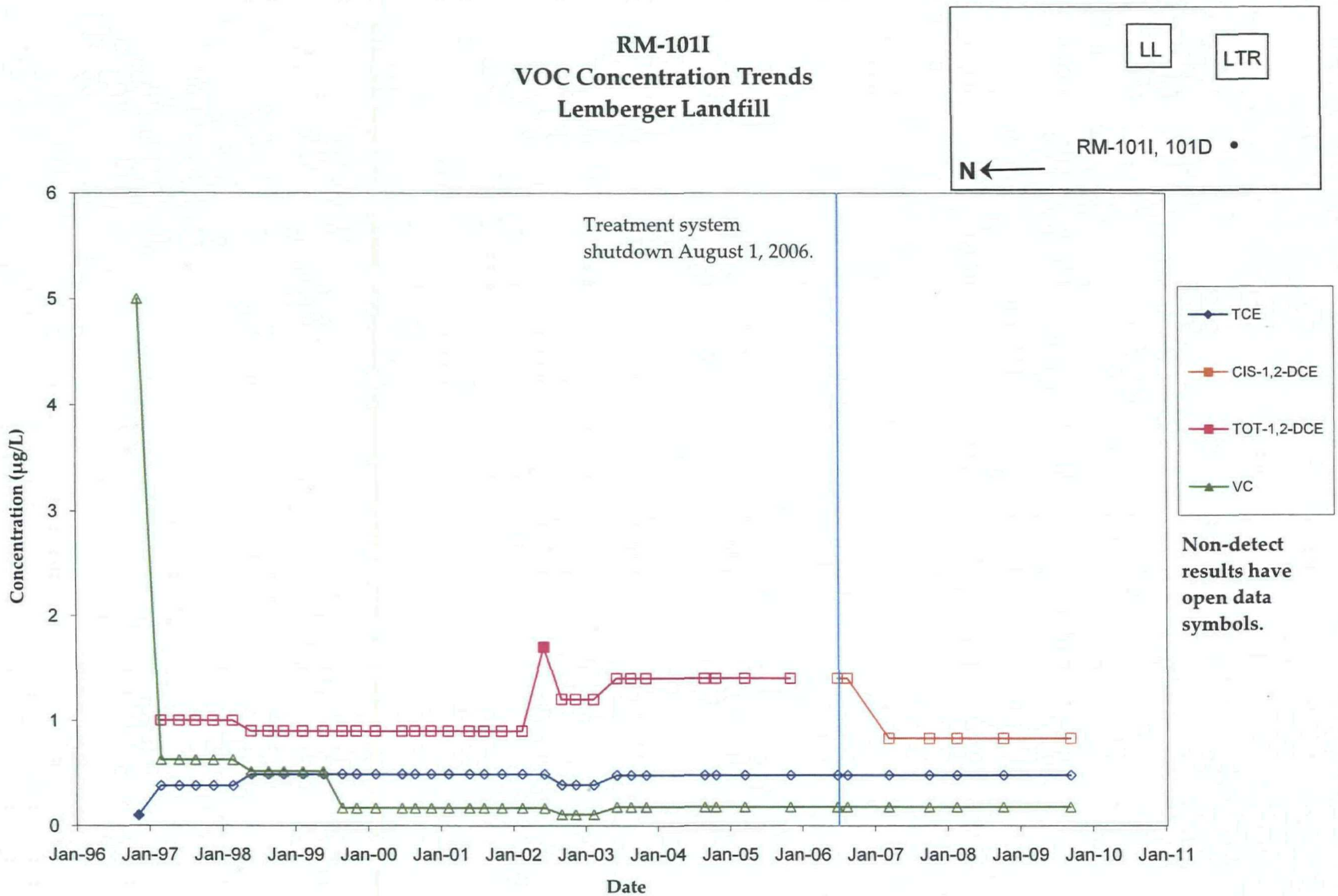


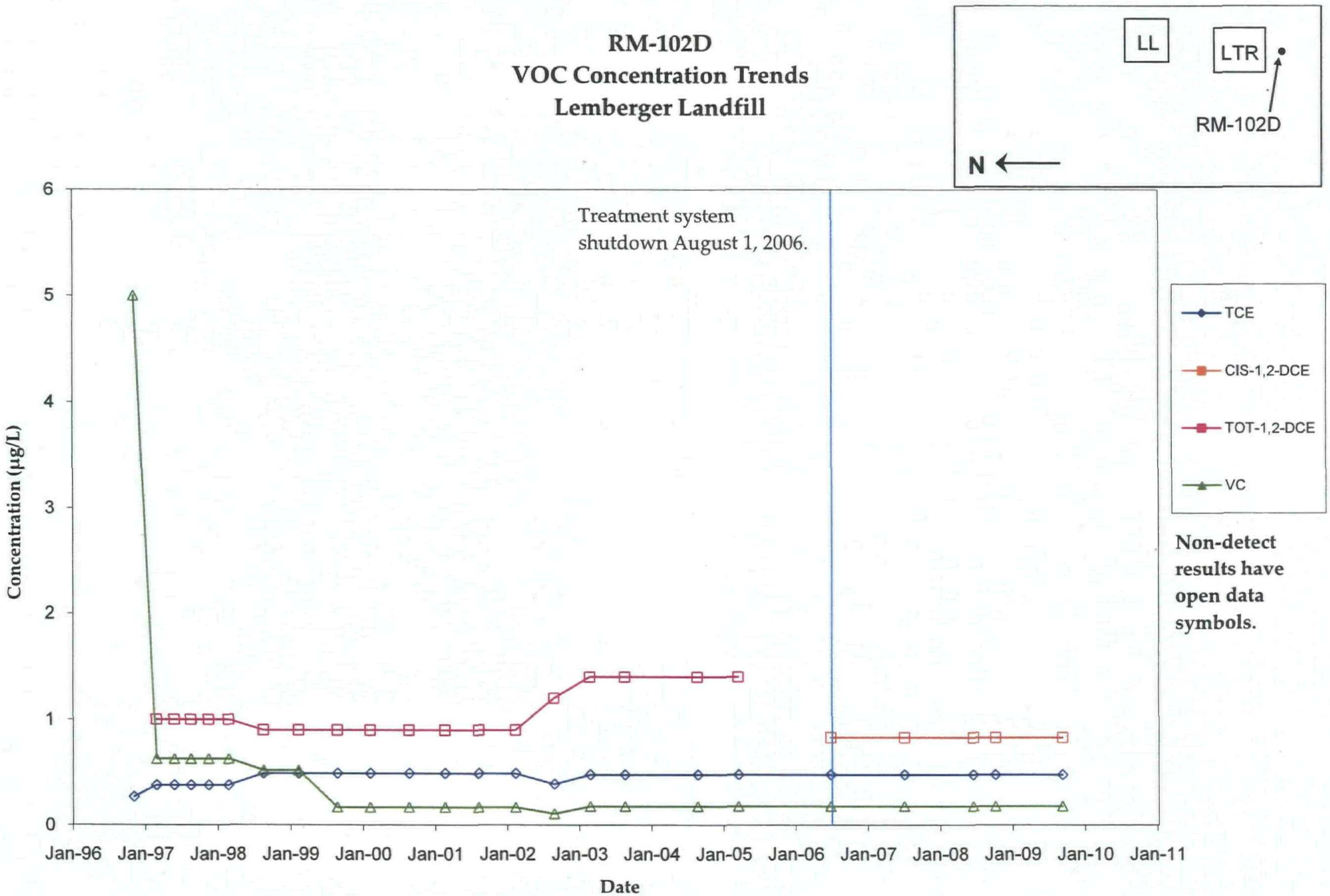
Non-detect results have open data symbols.



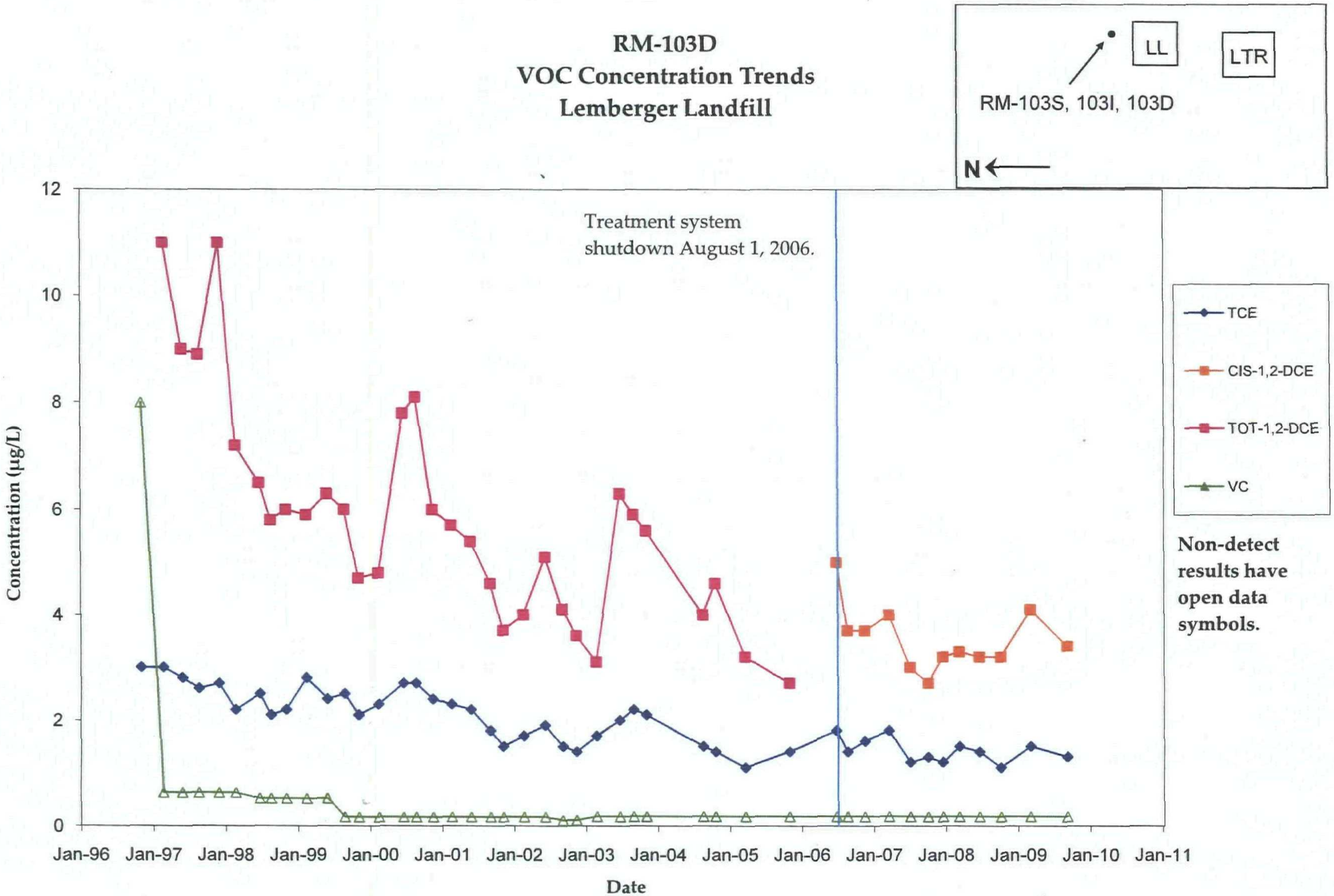
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010


RM-101D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-101I, 101D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
Date
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.

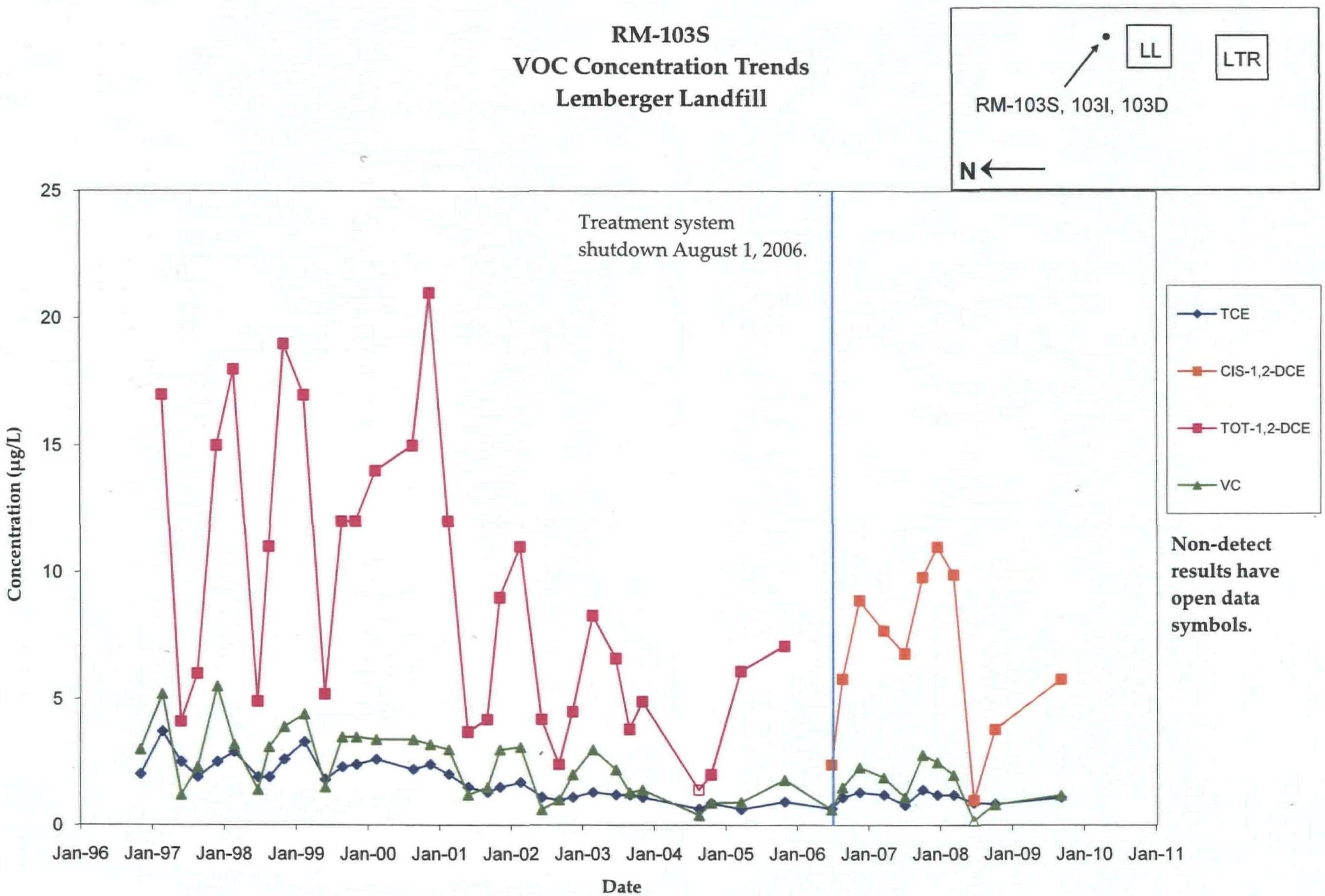

RM-101I
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-101I, 101D
N
Treatment system shutdown August 1, 2006.
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.
Concentration (µg/L)
Date
0
1
2
3
4
5
6
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11

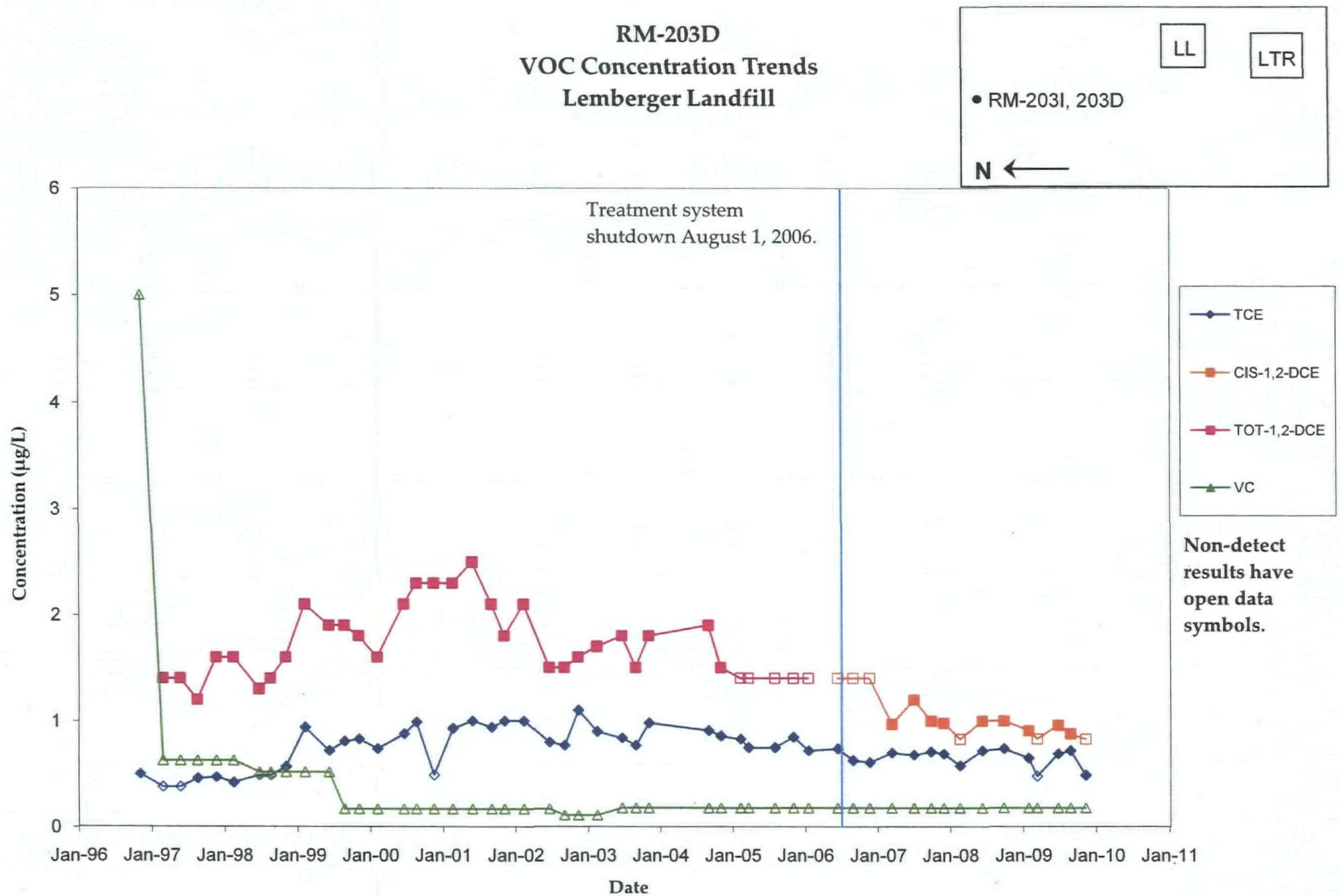


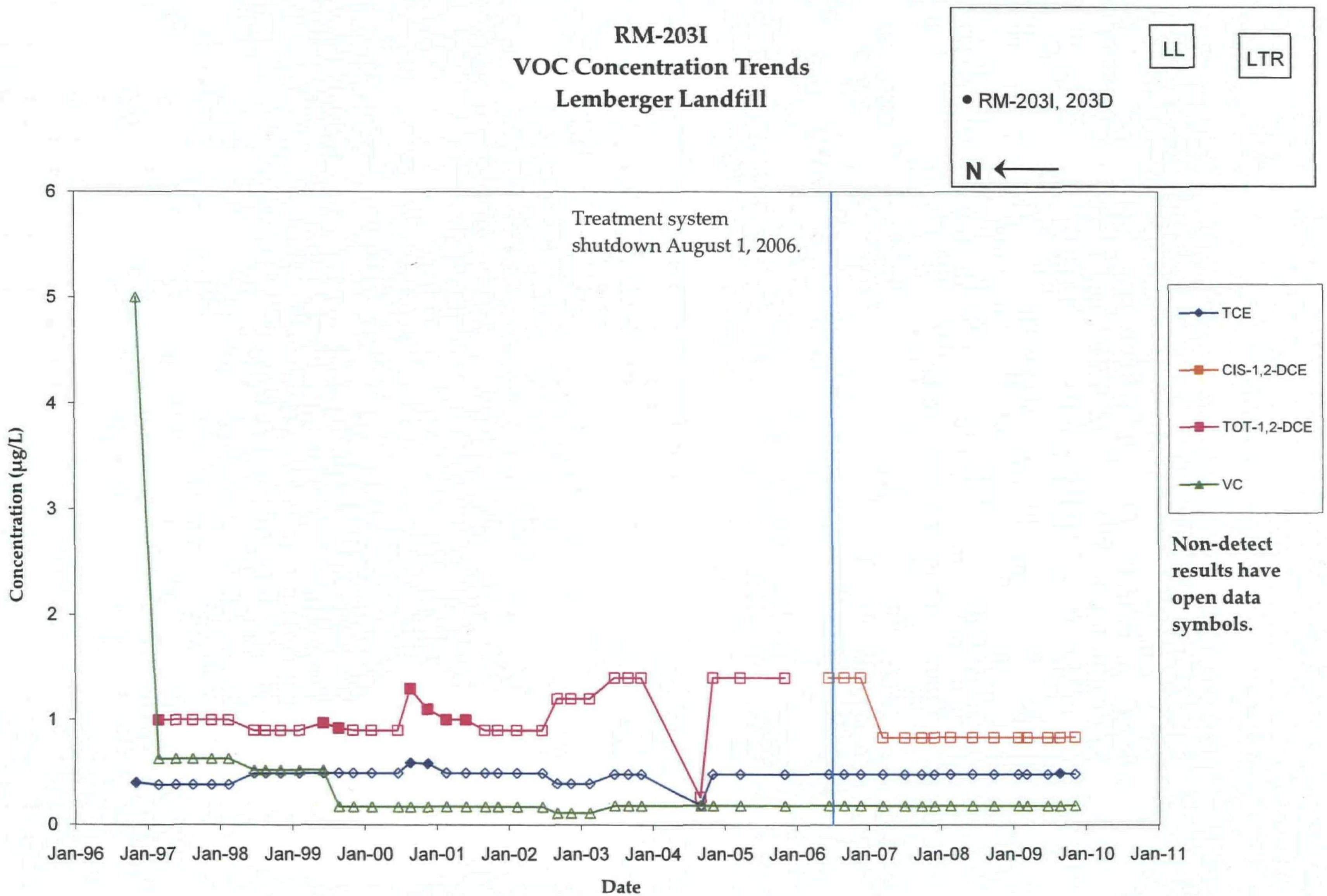
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010

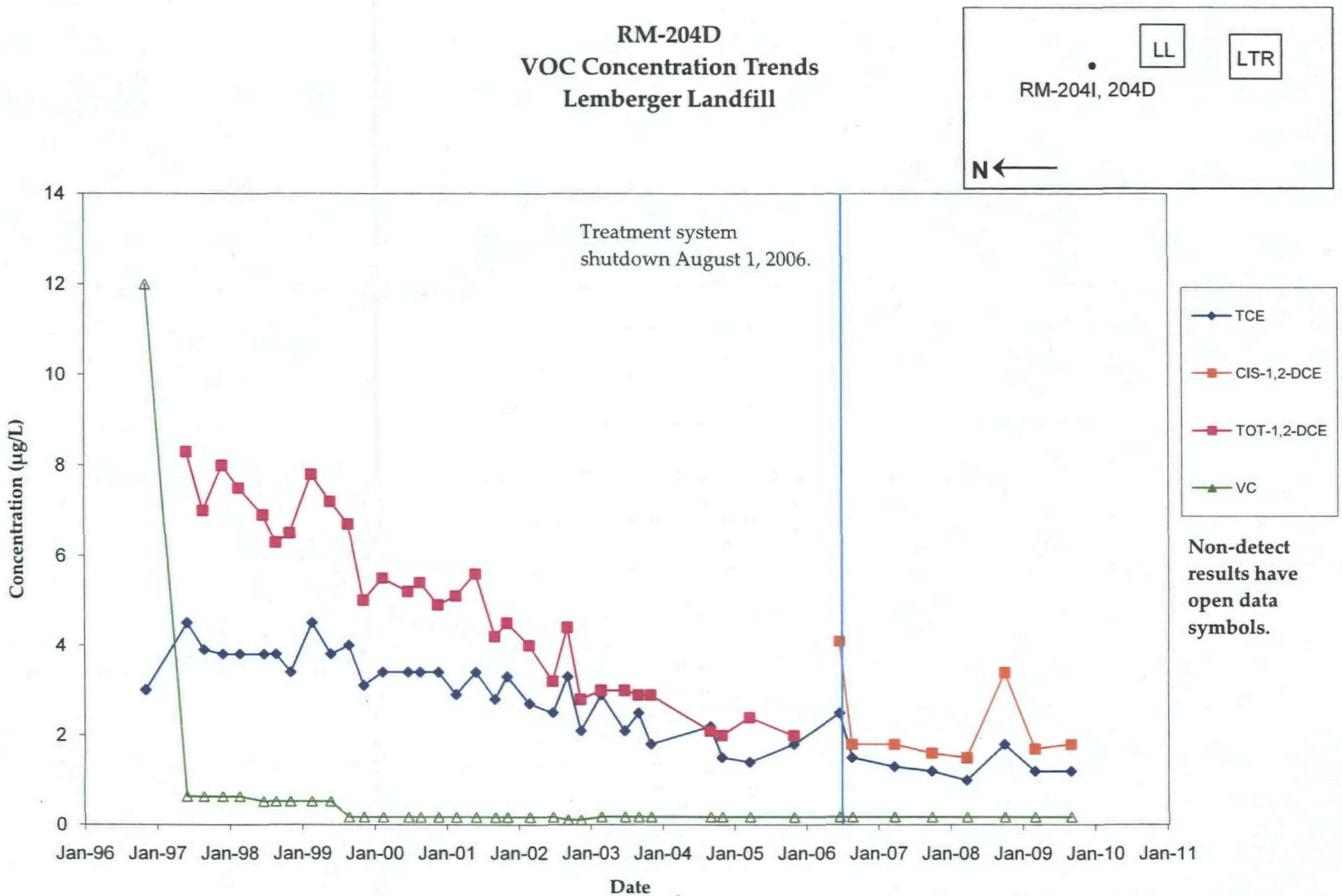


C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010


RM-103S
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-103S, 103I, 103D
N
Treatment system shutdown August 1, 2006.
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.
Concentration (µg/L)
25
20
15
10
5
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date

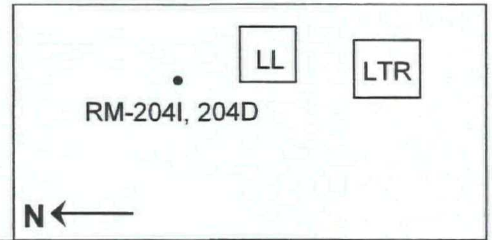

RM-203D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
• RM-203I, 203D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
6
5
4
3
2
1
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.

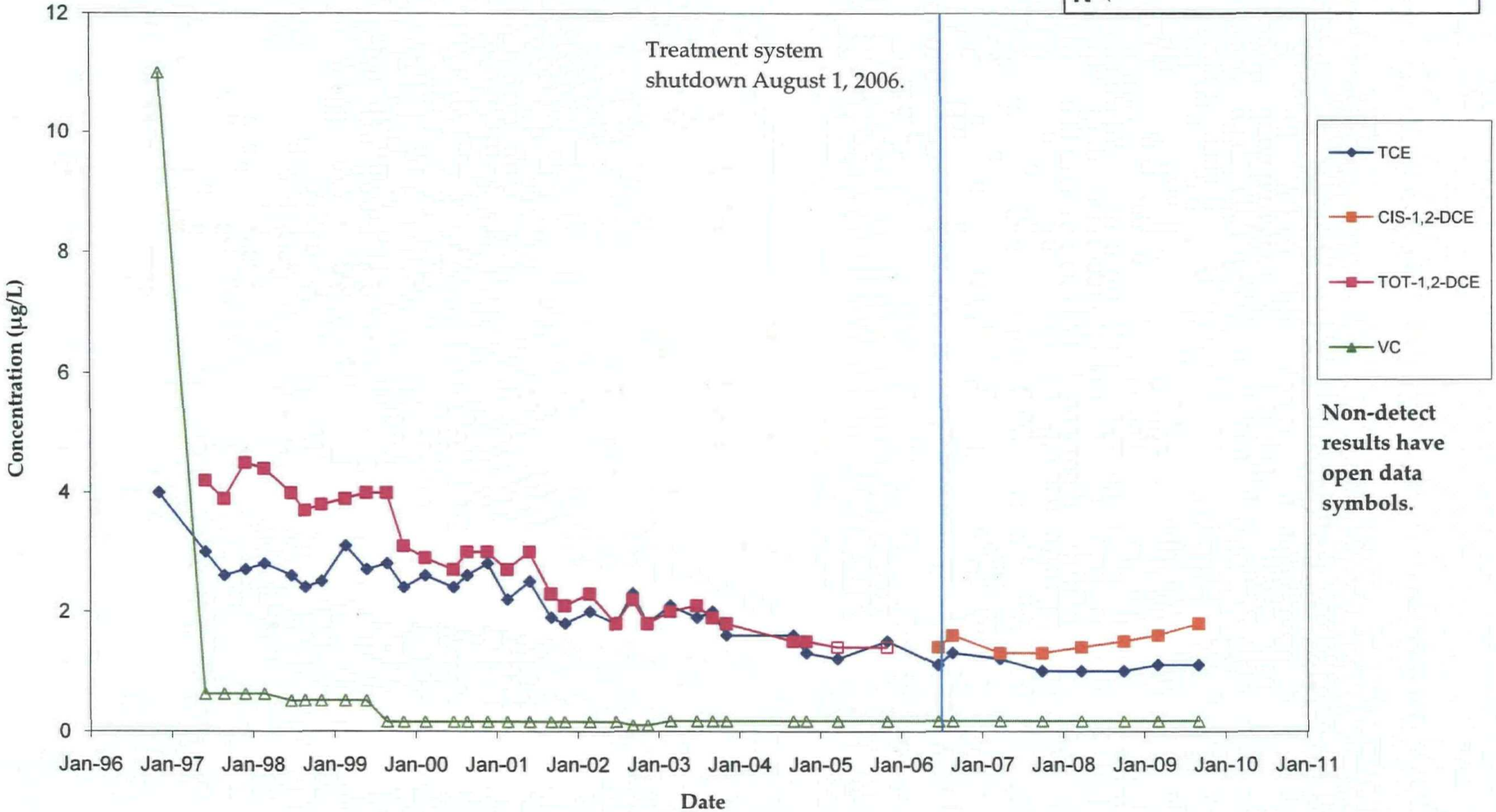

RM-203I
VOC Concentration Trends
Lemberger Landfill
LL
LTR
• RM-203I, 203D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
0
1
2
3
4
5
6
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.



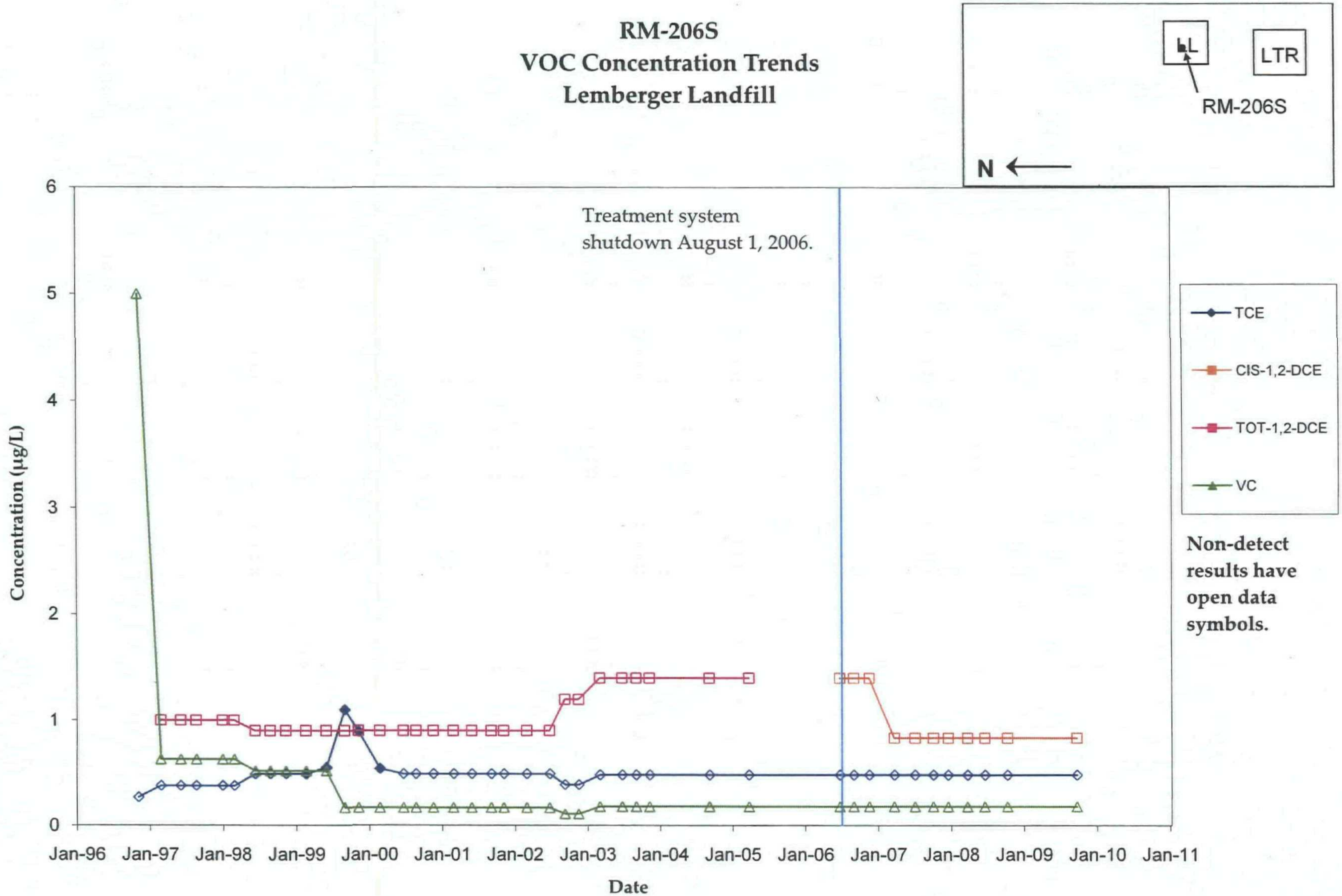
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010

RM-204I
VOC Concentration Trends
Lemberger Landfill

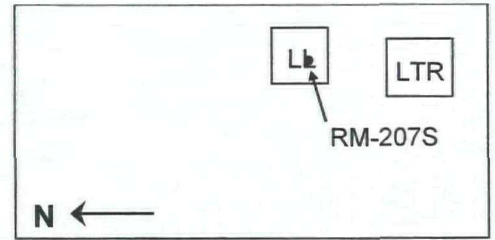




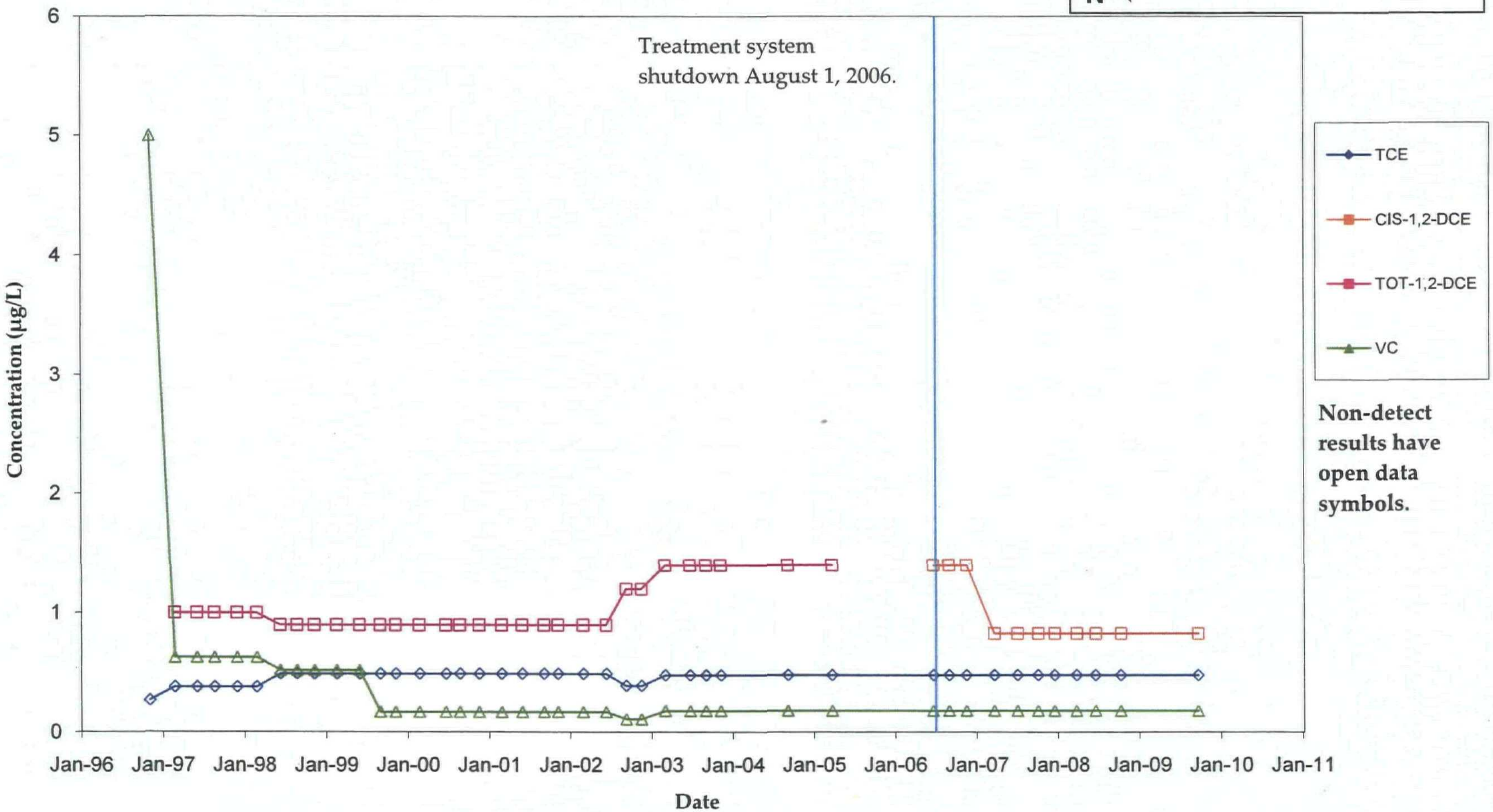
Non-detect results have open data symbols.



C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010



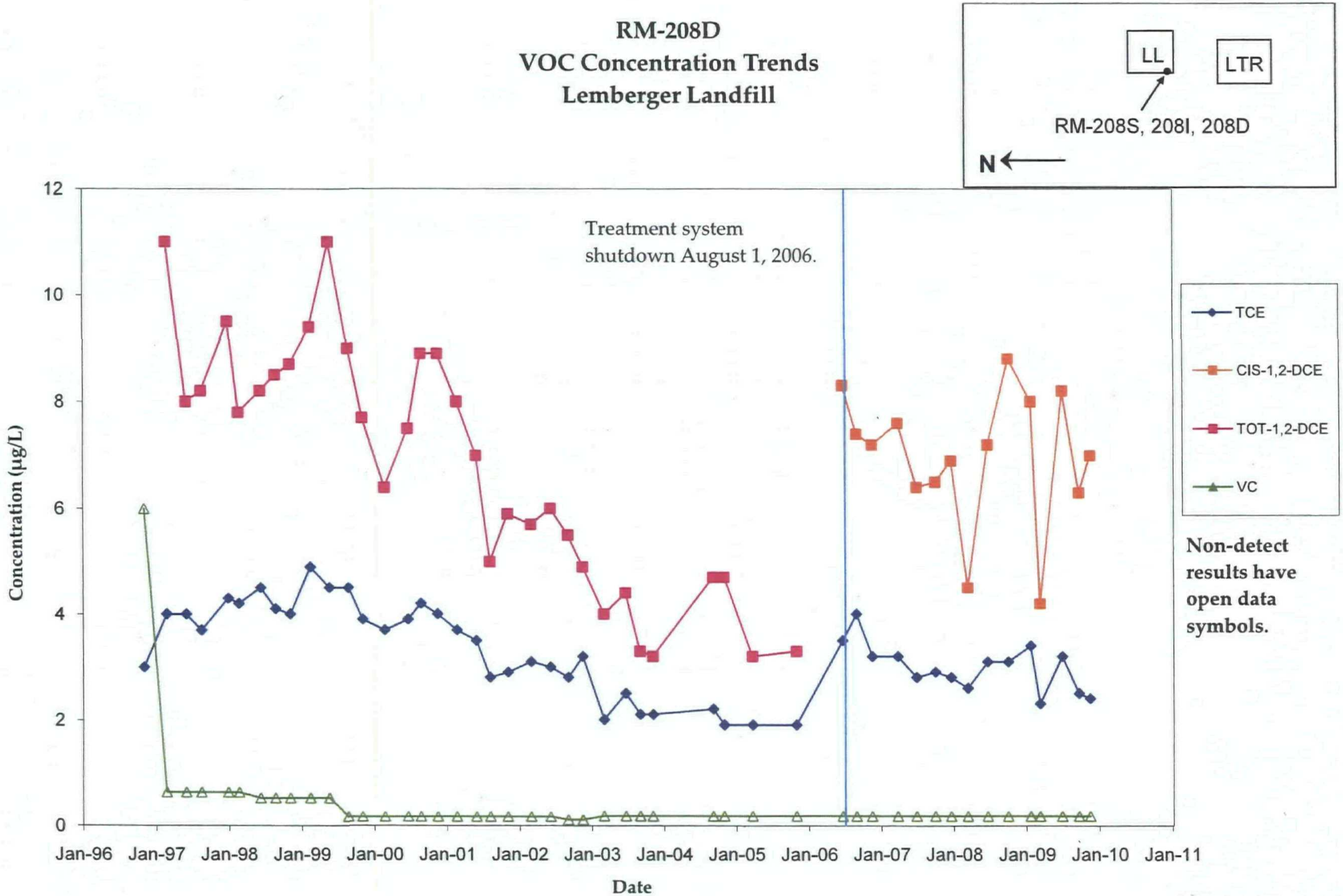
RM-207S
VOC Concentration Trends
Lemberger Landfill



Non-detect results have open data symbols.

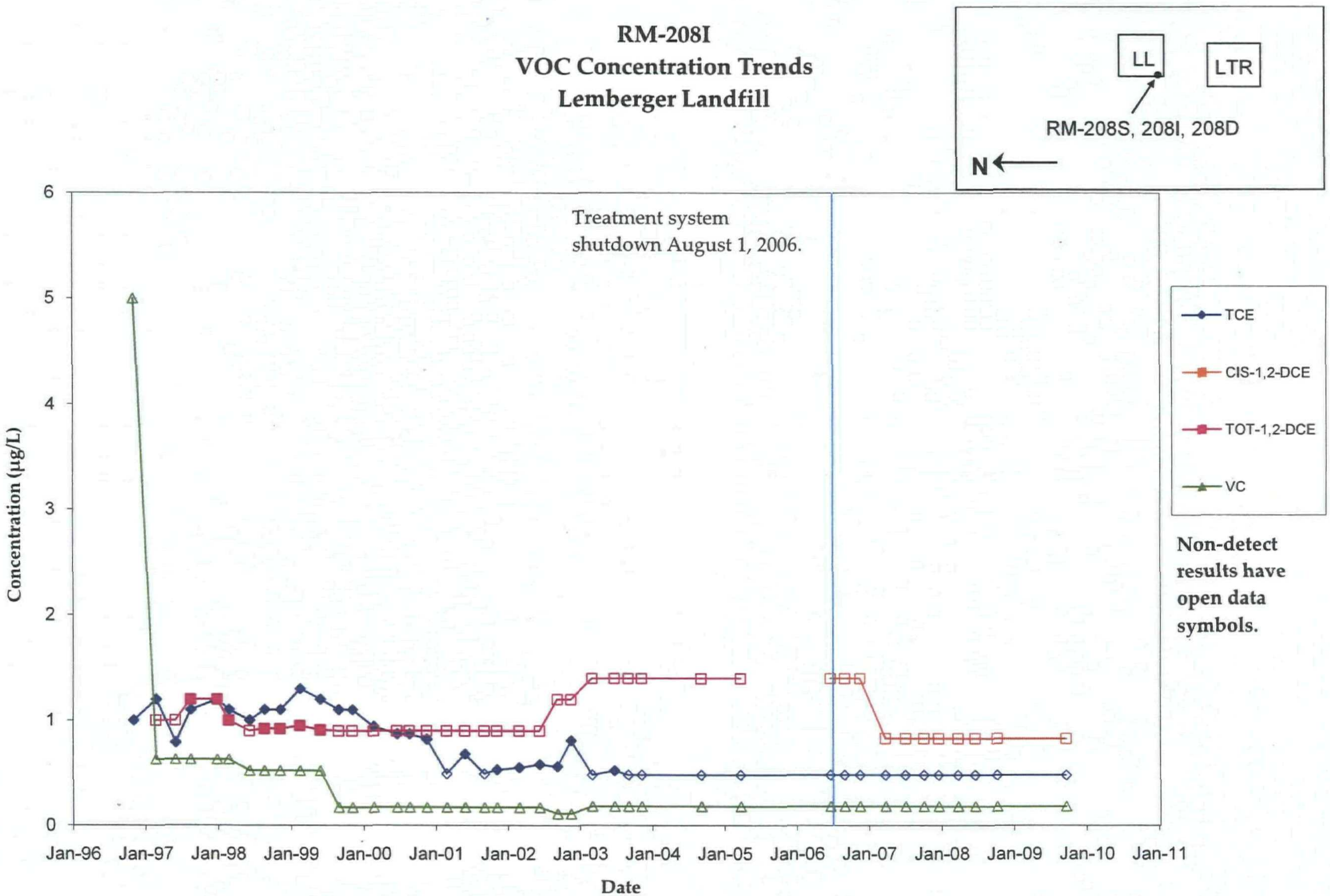
C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010

**RM-208D
VOC Concentration Trends
Lemberger Landfill**



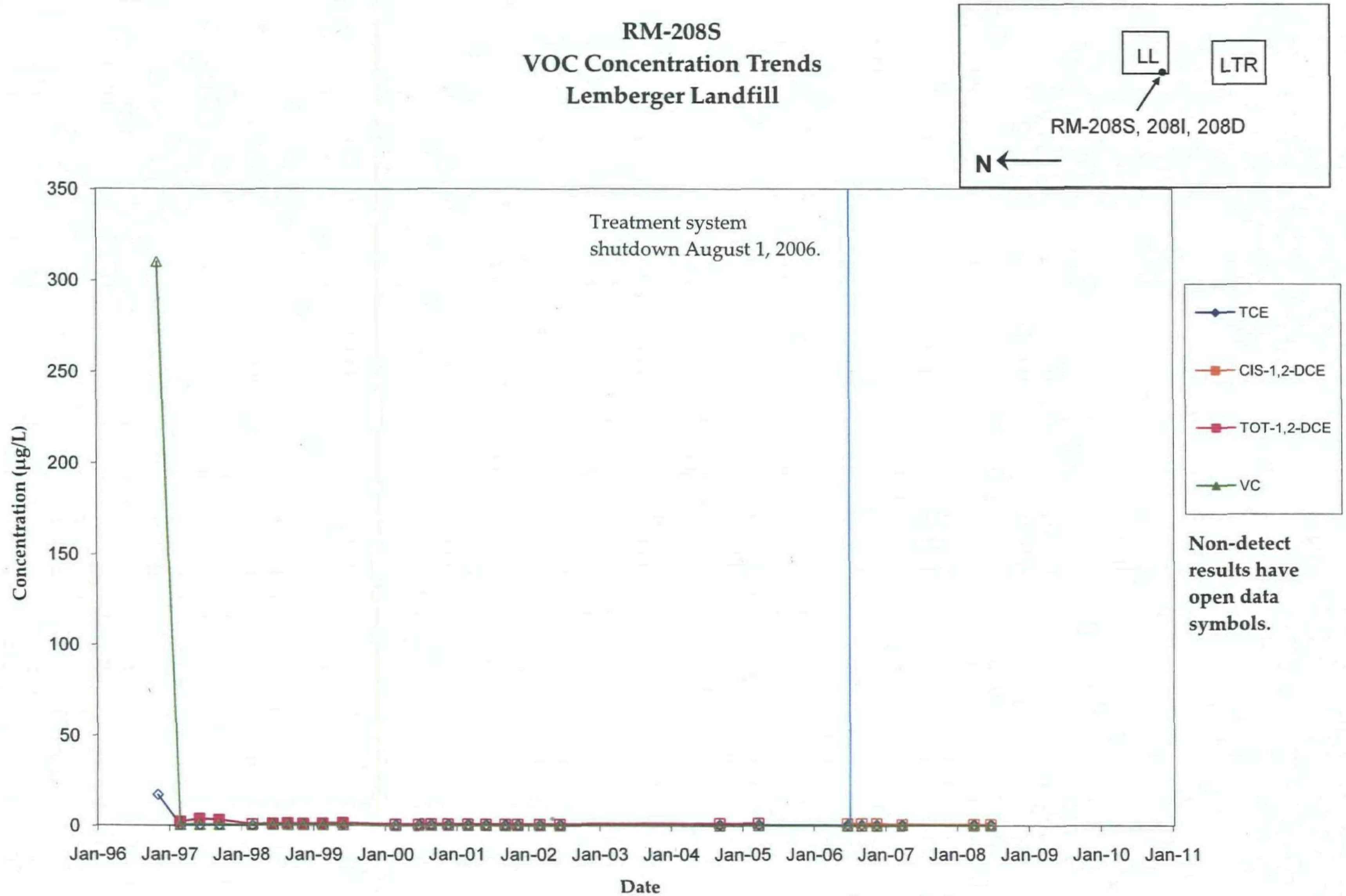
Non-detect results have open data symbols.

Exhibit 27
Page 92 of 108

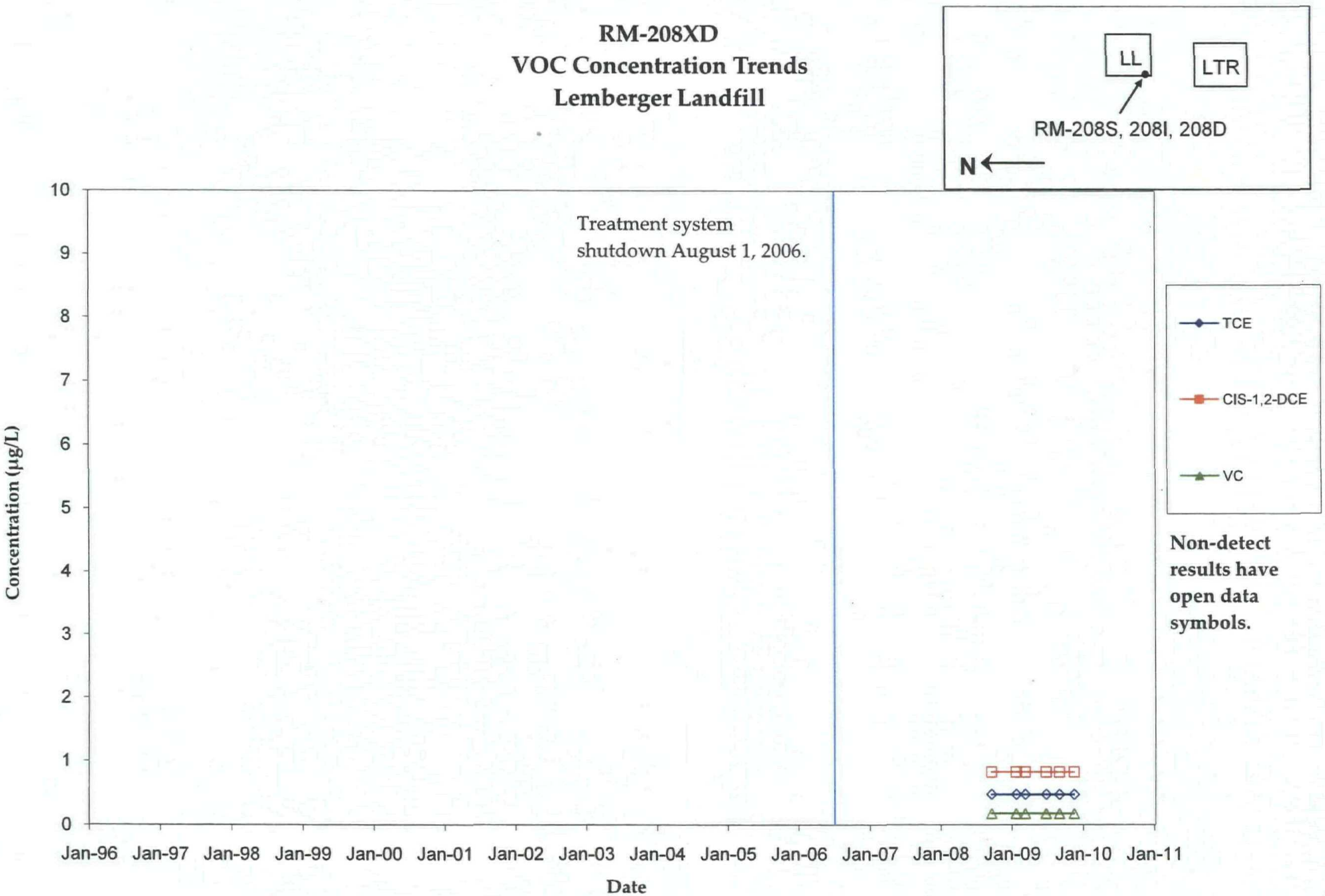


C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010

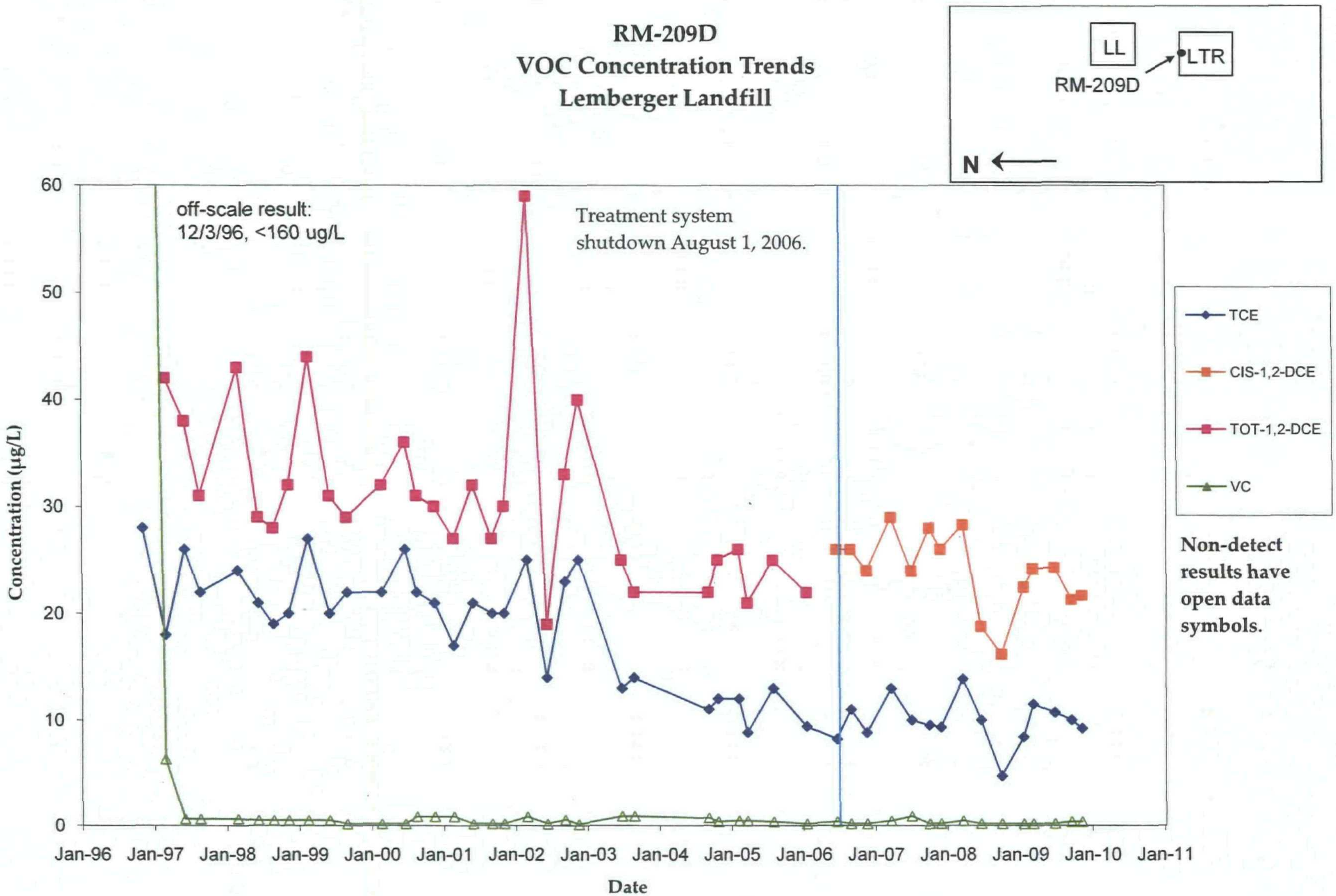
RM-208S
VOC Concentration Trends
Lemberger Landfill



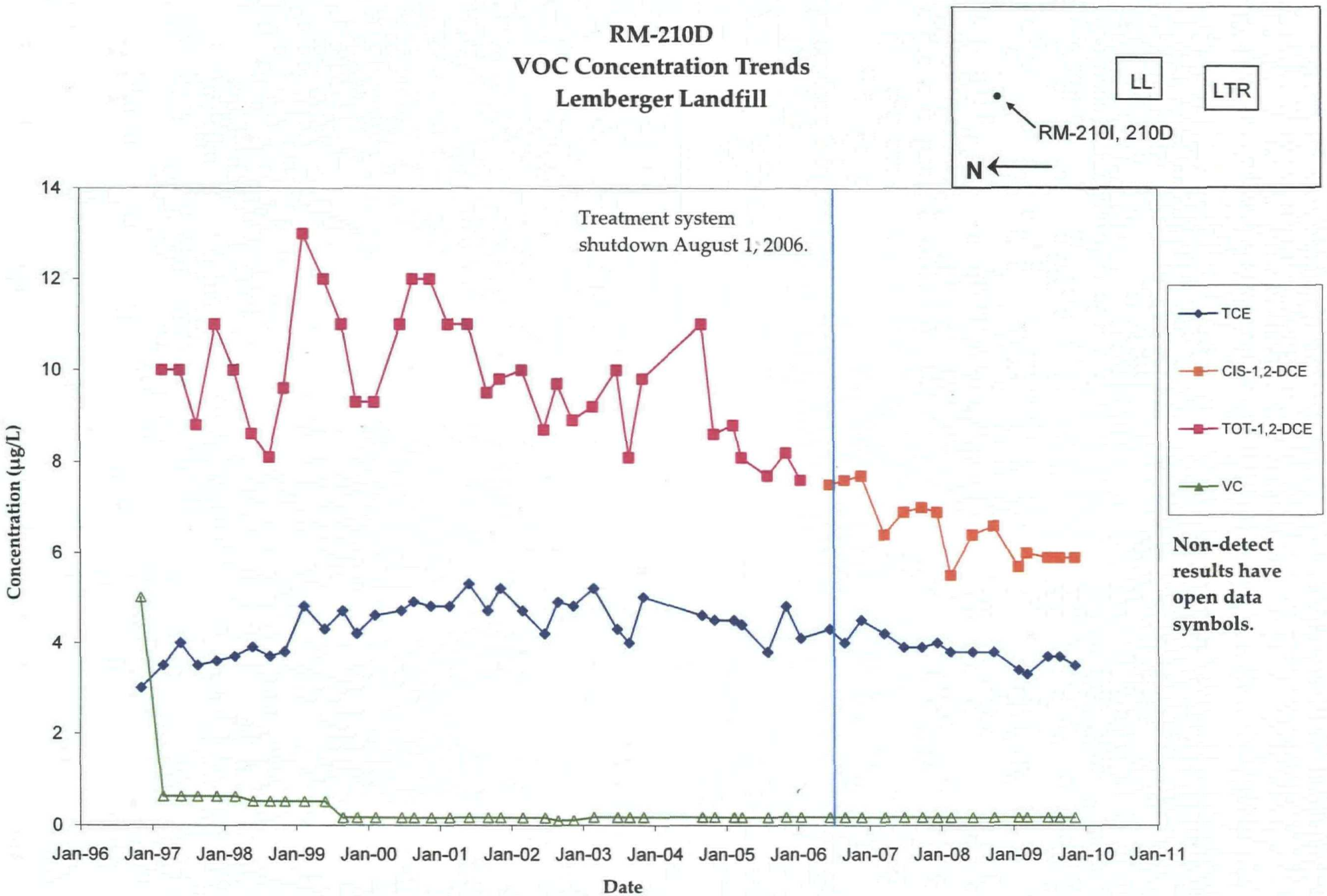
Non-detect results have open data symbols.


RM-208XD
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-208S, 208I, 208D
N
Treatment system shutdown August 1, 2006.
Concentration (µg/L)
10
9
8
7
6
5
4
3
2
1
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
TCE
CIS-1,2-DCE
VC
Non-detect results have open data symbols.

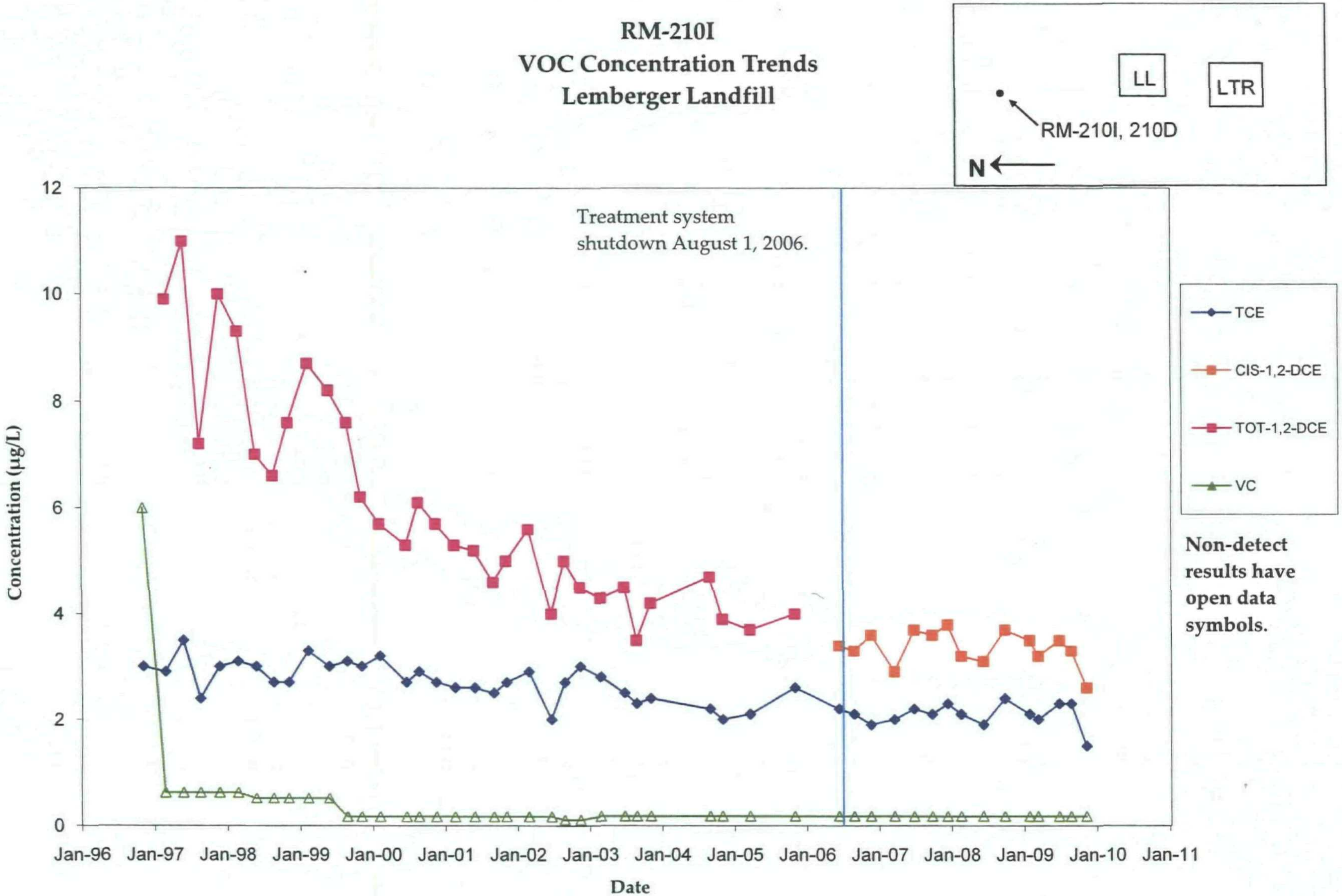
RM-209D
VOC Concentration Trends
Lemberger Landfill



C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010

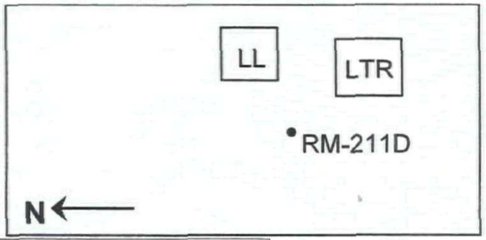

RM-210D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-210I, 210D
N
Treatment system shutdown August 1, 2006.
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.
Concentration (µg/L)
Date
0
2
4
6
8
10
12
14
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11

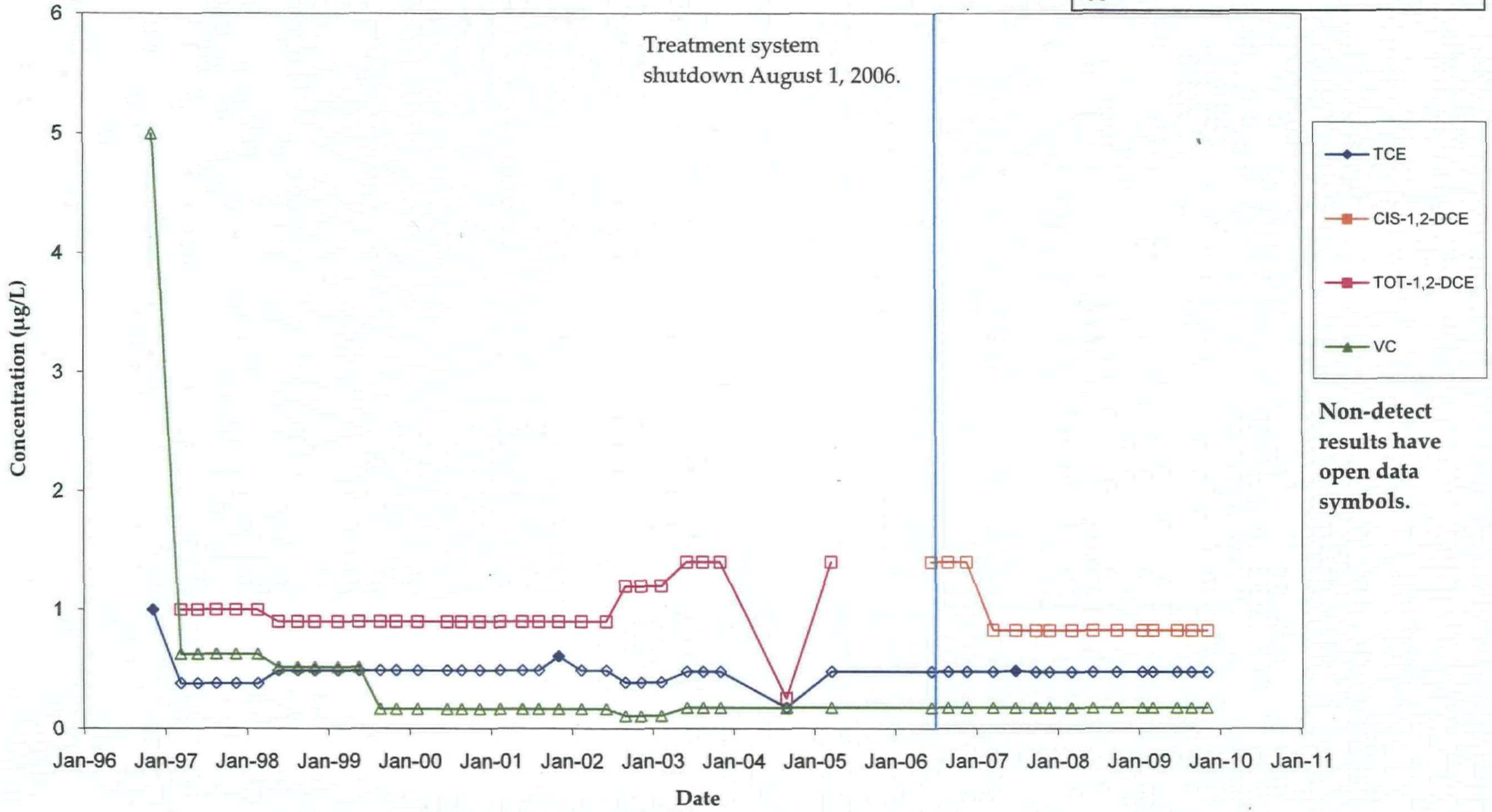
RM-210I
VOC Concentration Trends
Lemberger Landfill



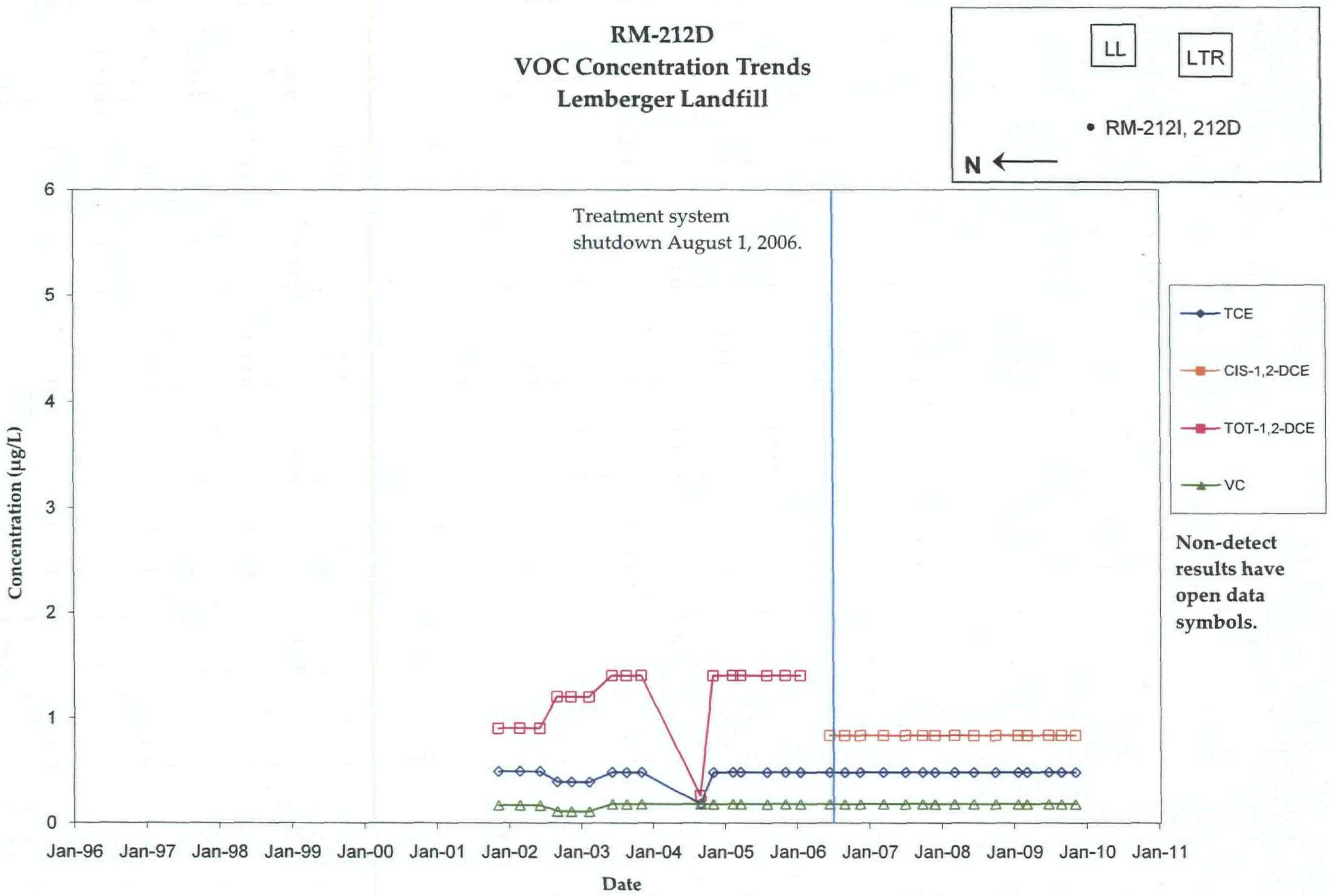
Non-detect results have open data symbols.

RM-211D
VOC Concentration Trends
Lemberger Landfill



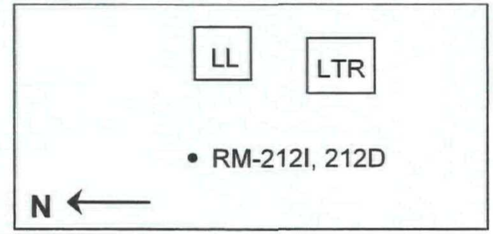


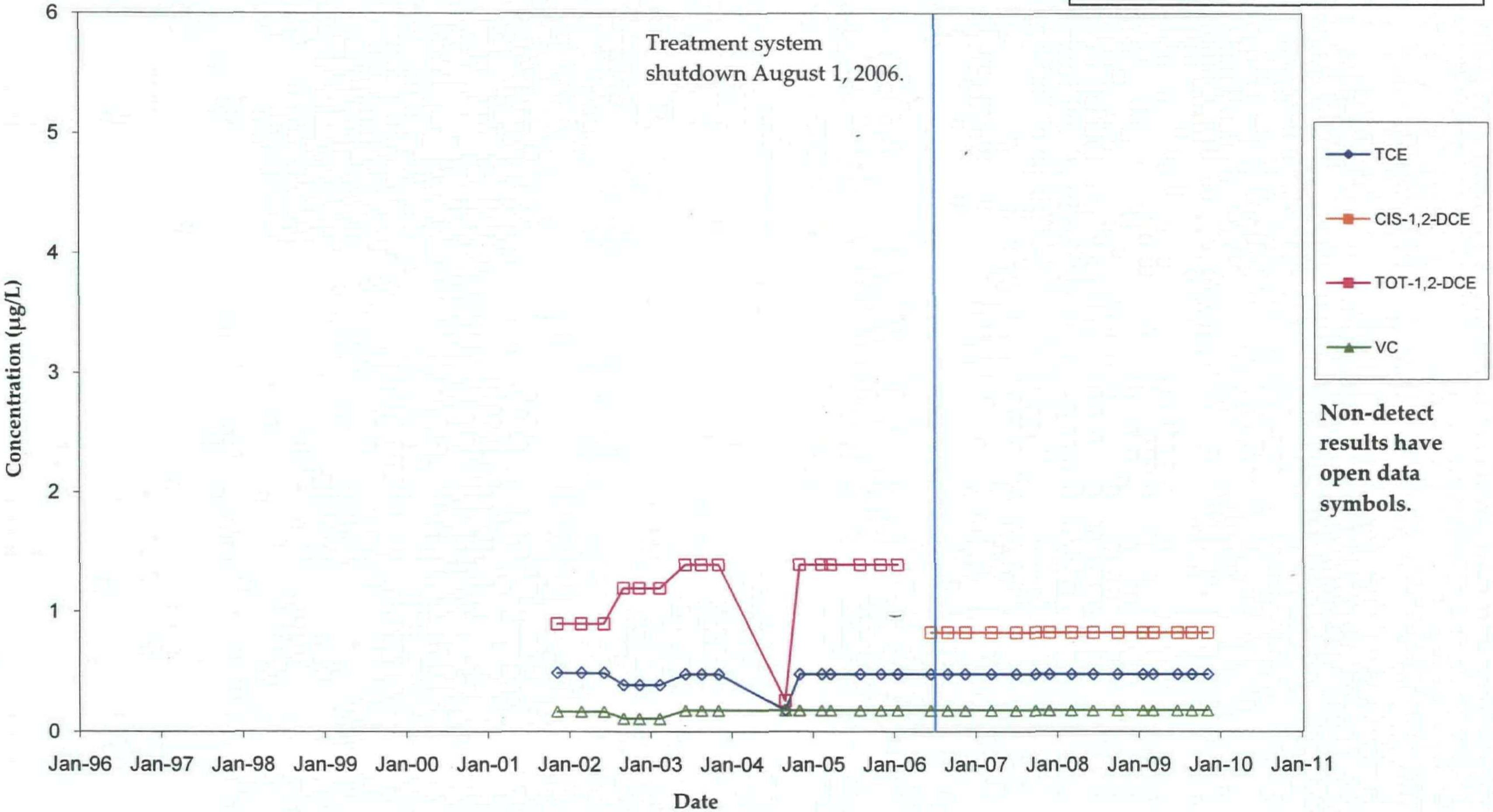
Non-detect results have open data symbols.



C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010

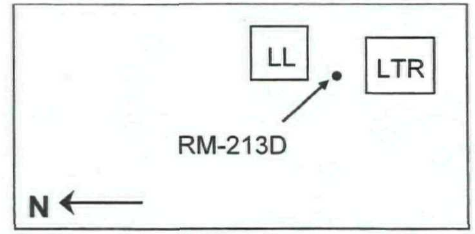
RM-212I
VOC Concentration Trends
Lemberger Landfill

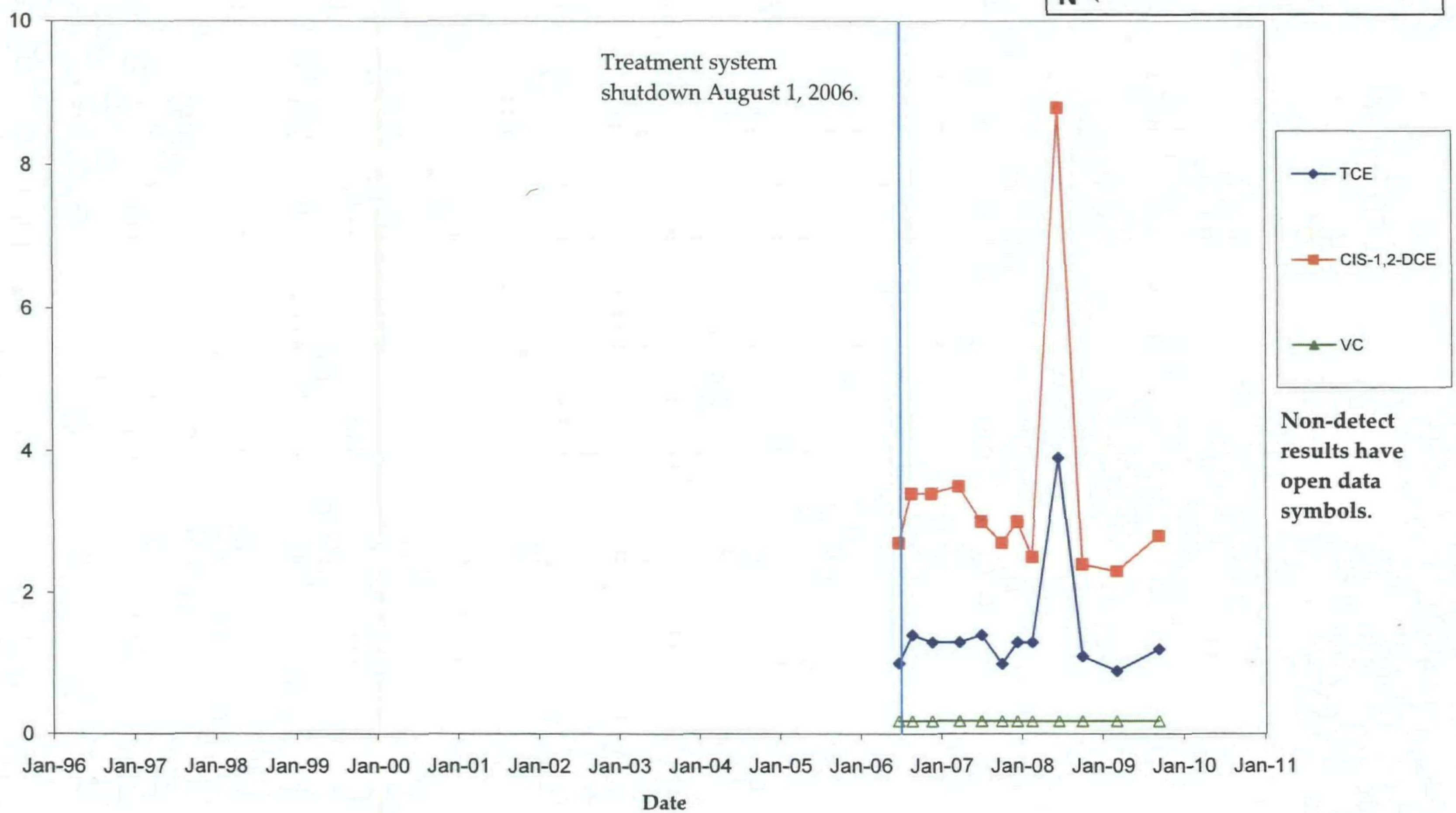




Non-detect results have open data symbols.

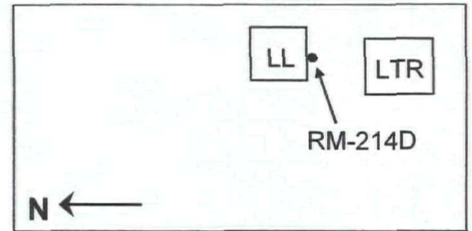
RM-213D
VOC Concentration Trends
Lemberger Landfill

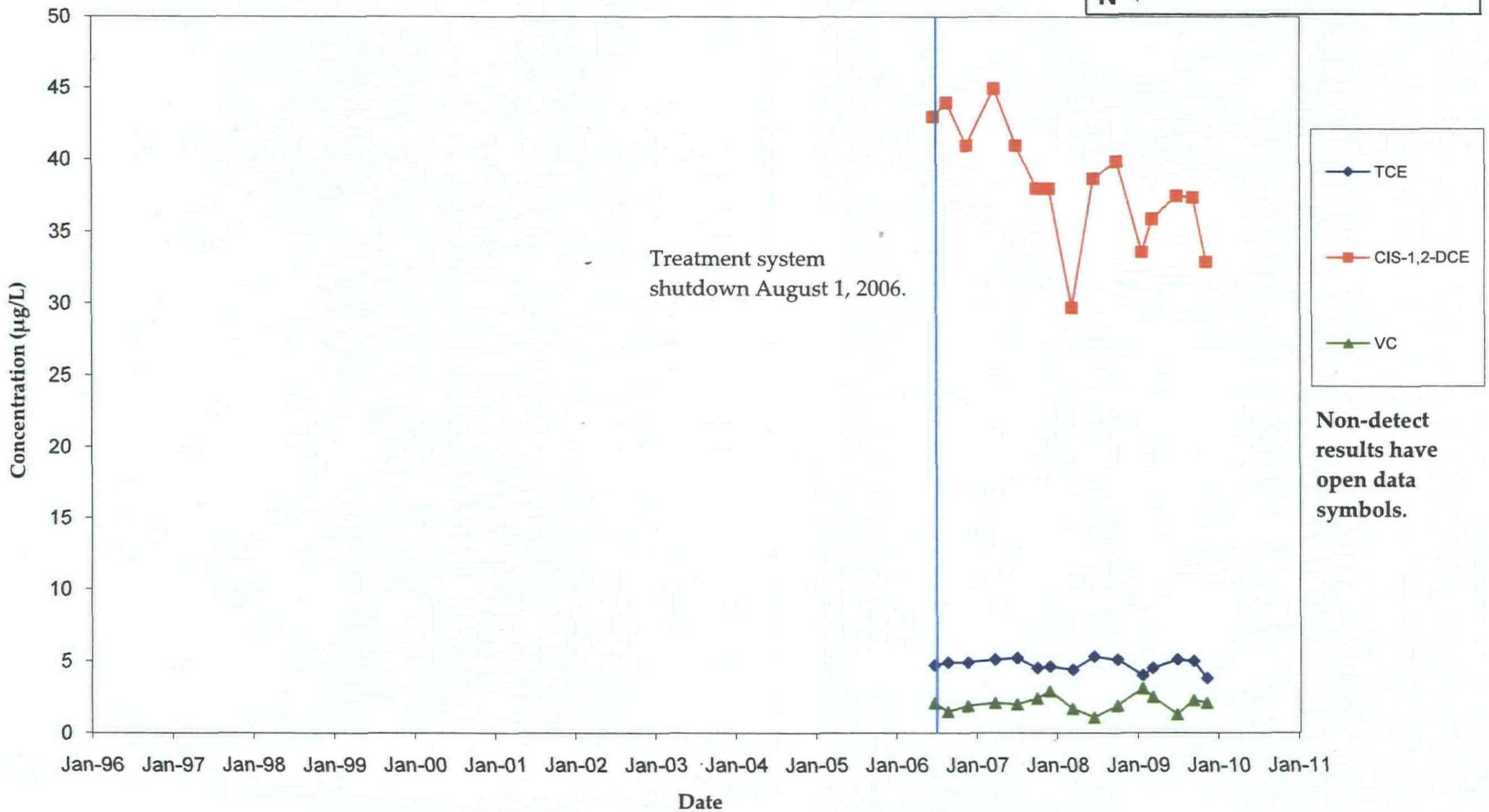




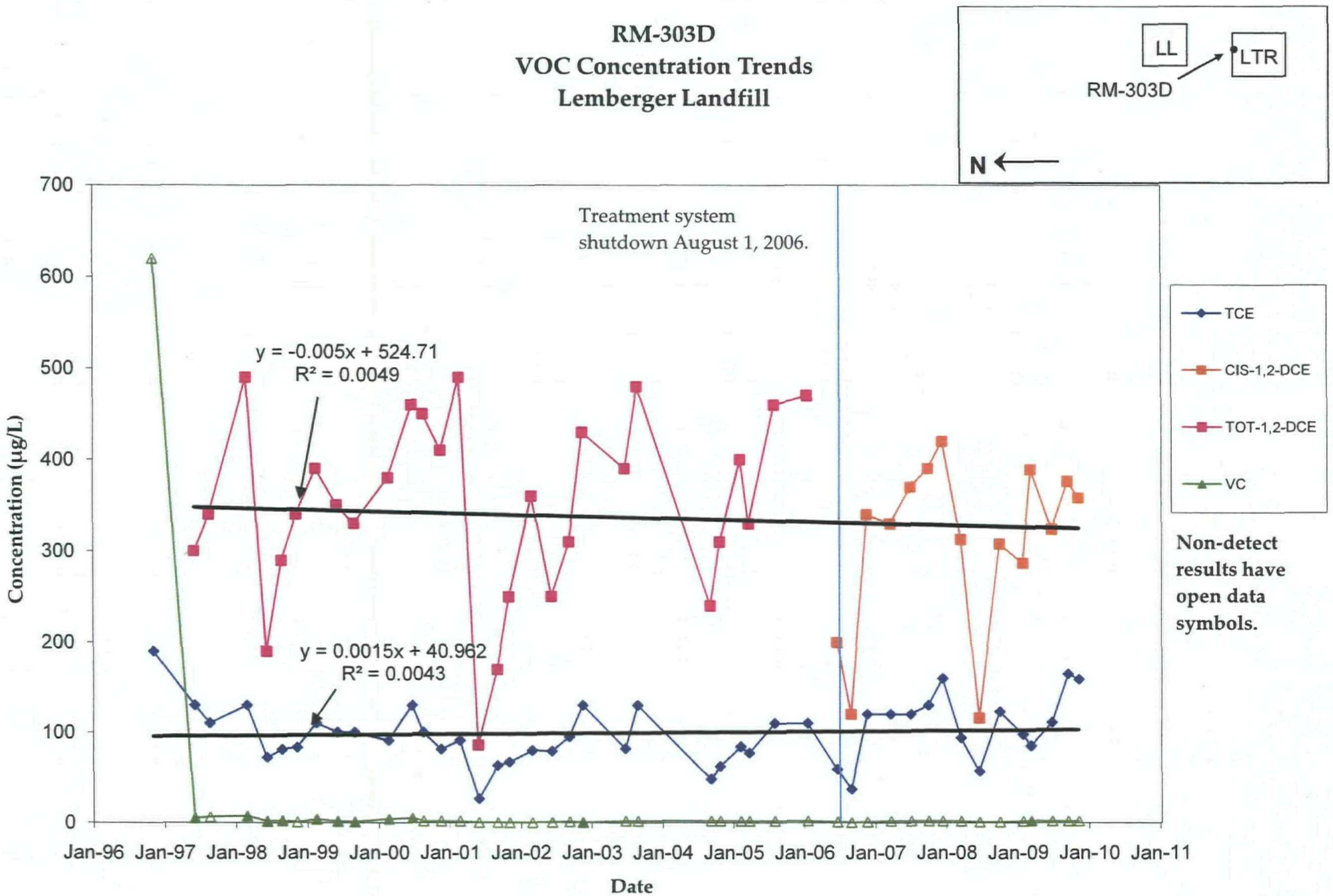
Non-detect results have open data symbols.

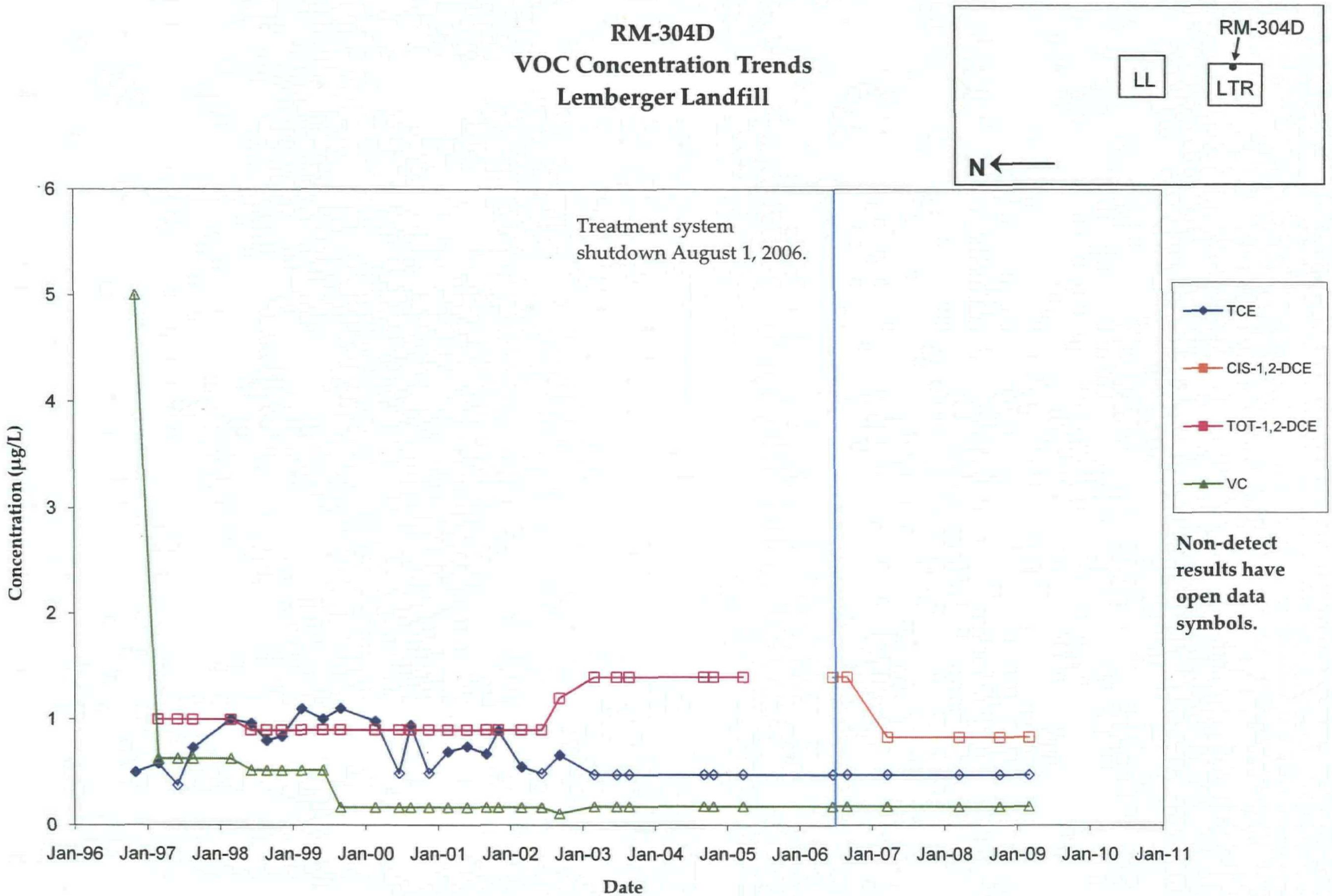
RM-214D
VOC Concentration Trends
Lemberger Landfill

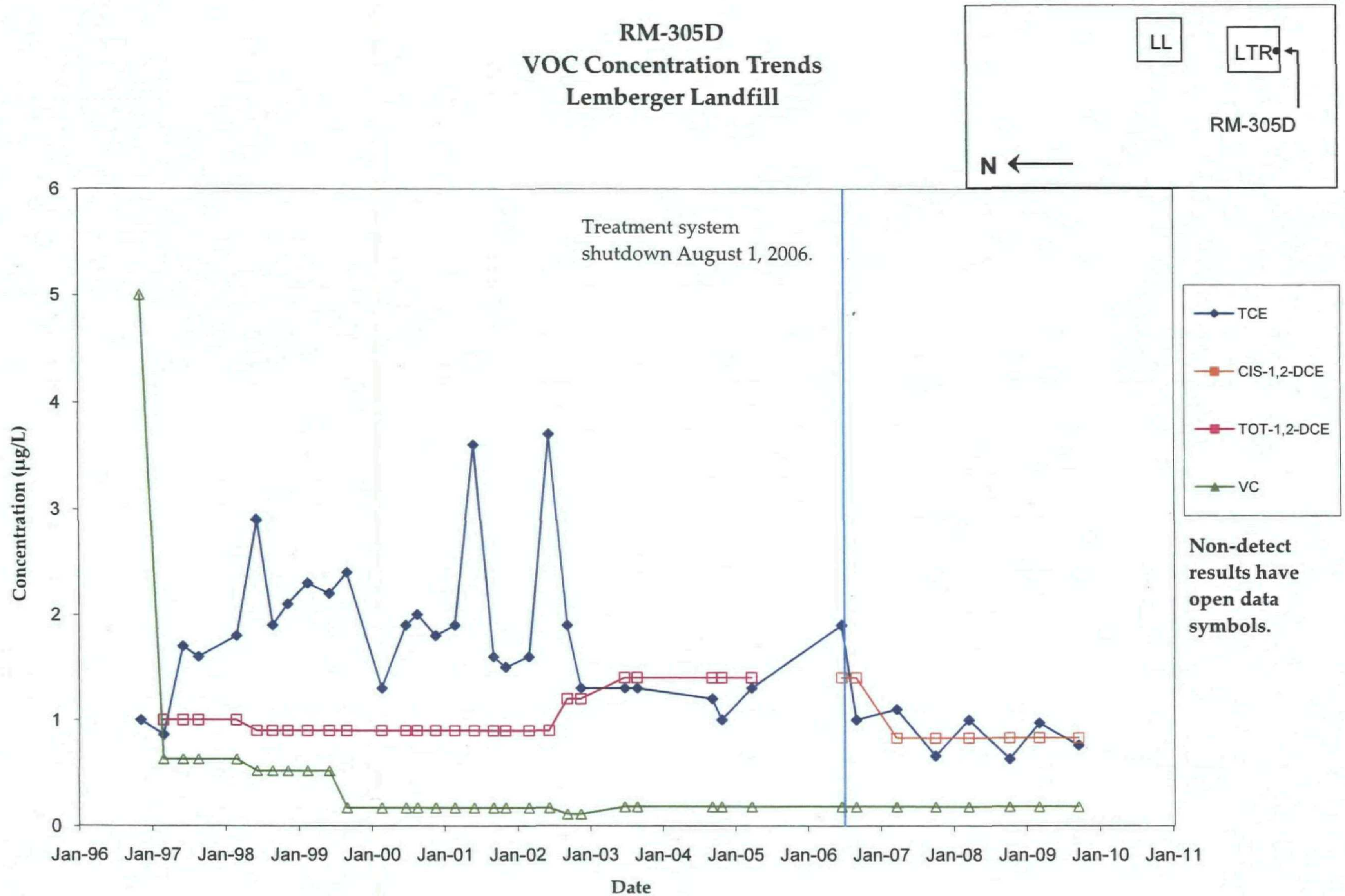


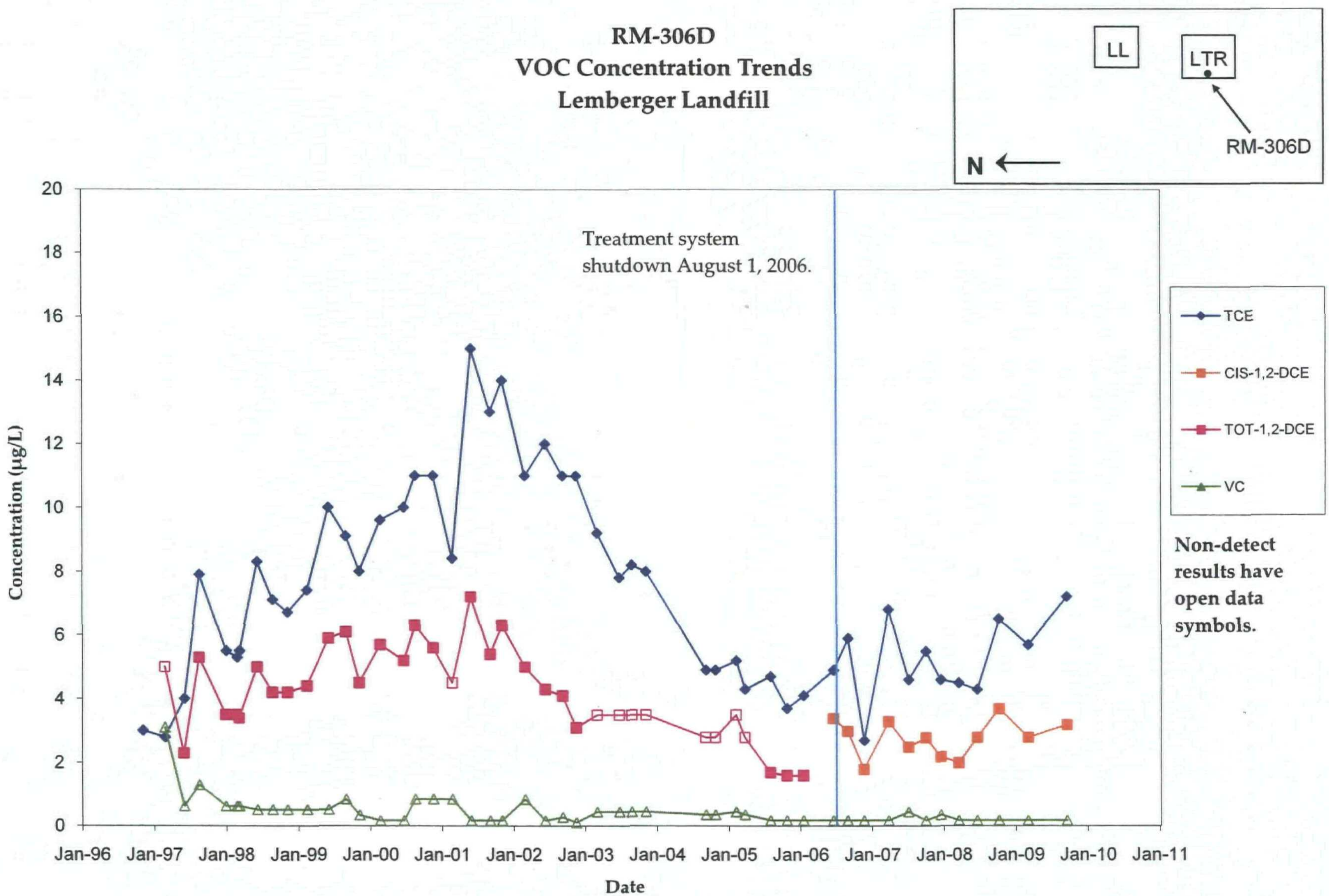


Non-detect results have open data symbols.

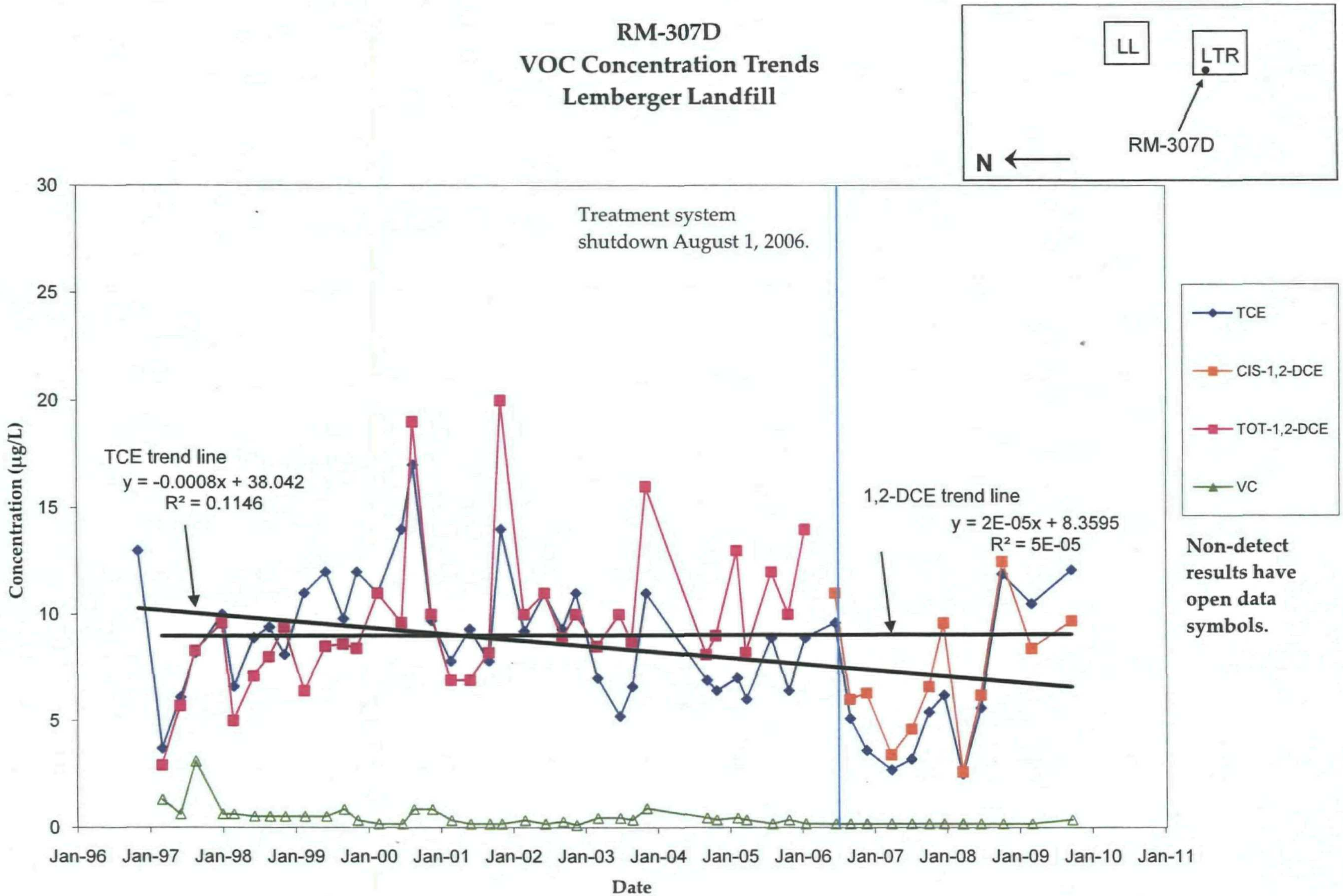

RM-303D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-303D
N
Treatment system
shutdown August 1, 2006.
y = -0.005x + 524.71
R² = 0.0049
y = 0.0015x + 40.962
R² = 0.0043
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect
results have
open data
symbols.
Concentration (µg/L)
Date
700
600
500
400
300
200
100
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11


RM-304D
VOC Concentration Trends
Lemberger Landfill
RM-304D
LL
LTR
N
Treatment system shutdown August 1, 2006.
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.
Concentration (µg/L)
0
1
2
3
4
5
6
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date


RM-305D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-305D
N
Treatment system
shutdown August 1, 2006.
Concentration (µg/L)
6
5
4
3
2
1
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.


RM-306D
VOC Concentration Trends
Lemberger Landfill
LL
LTR
RM-306D
N
Treatment system shutdown August 1, 2006.
TCE
CIS-1,2-DCE
TOT-1,2-DCE
VC
Non-detect results have open data symbols.
Concentration (µg/L)
20
18
16
14
12
10
8
6
4
2
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Date

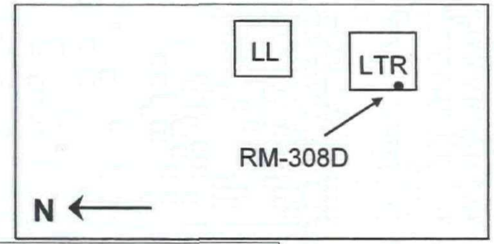
RM-307D
VOC Concentration Trends
Lemberger Landfill

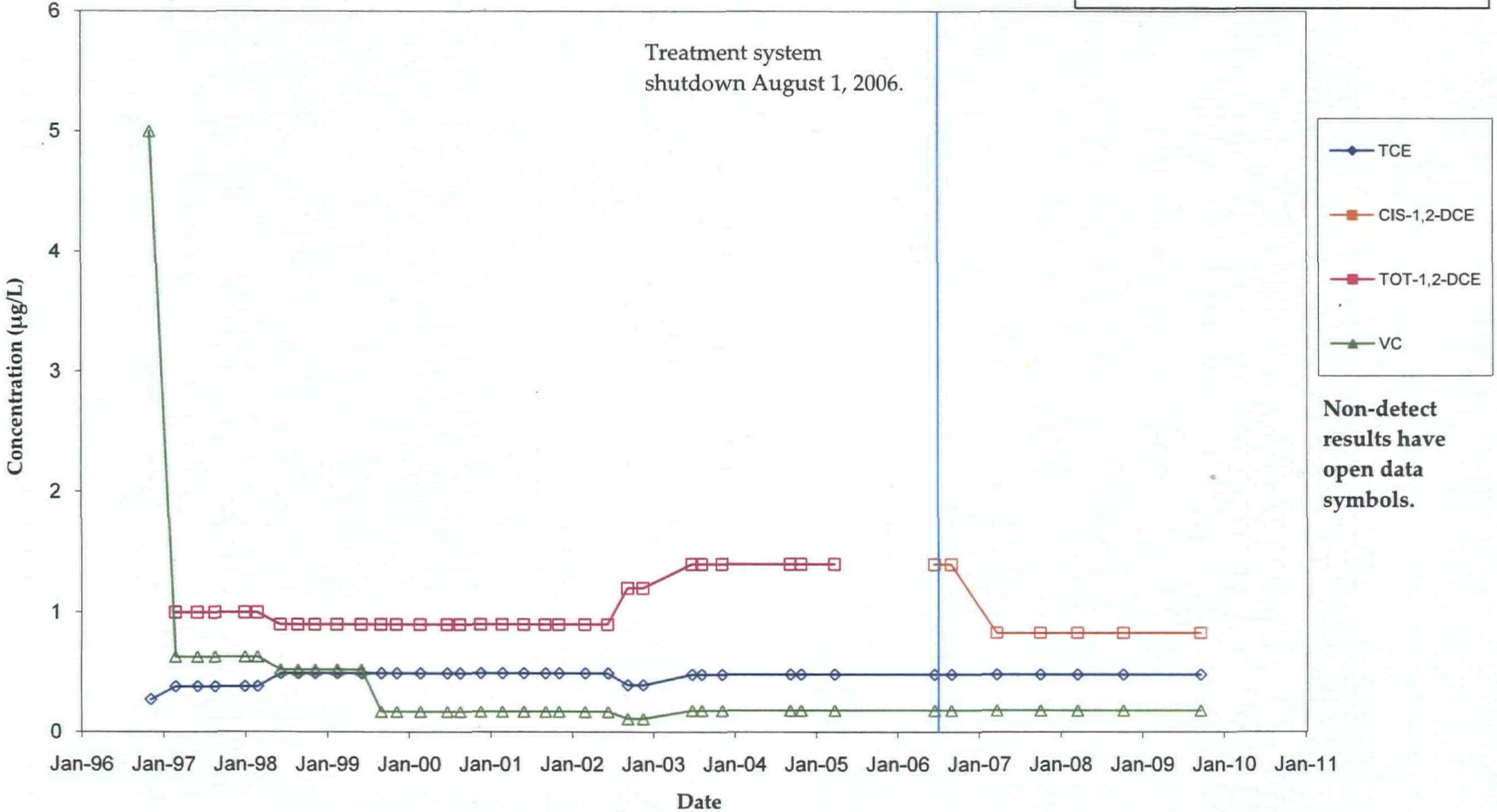


Non-detect results have open data symbols.

C:\Documents and Settings\wedekinj\Local Settings\Temporary Internet Files\Content.Outlook\TJRBU7ZP\VOC-ene TRENDS 02 2010.xlsm 4/5/2010

RM-308D
VOC Concentration Trends
Lemberger Landfill





Non-detect results have open data symbols.

DATE: April 30, 2010

SUBJECT: April 7, 2010 site inspection at LL and LTR

FROM: Richard Boice, RPM, Region 5, EPA

TO: Annette Weissbach, Hydrogeologist, WDNR

Following is a report on the site inspection. Before meeting other participants, Richard Boice of EPA and David Dougherty of Subterranean Research drove by and observed the downgradient monitoring wells, residences and Branch Creek. The following persons met at the groundwater treatment building (6024 Hempton Lake Road near Whitelaw, Wisconsin) at 10:00 AM and participated in the inspection:

- Douglas Clark, Foley & Lardner
- James Wallner, Red Arrow
- James Wedekind, professional geologist, RMT
- Mark Brooks, on-site operator, RMT
- David Dougherty, Subterranean Research
- Annette Weissbach, WDNR
- Richard Boice, EPA

The inspection included observation and discussion of the following: the groundwater treatment; the leachate collection; the site cover, drainage, leachate withdrawal wells, and monitoring wells at LL; the site cover, drainage, pumping wells, shallow groundwater sumps, and monitoring wells at LTR; and studying rock formations at a nearby quarry and road cut. During the inspection it was cool (about 50 degrees Fahrenheit) and overcast. It had rained heavily the day and night before so puddles of water were observed at low spots, but it did not rain during the inspection. There are two steel buildings on-site, a groundwater treatment building and the leachate building. Both buildings appeared to be in good repair. According to Mr. Brooks, the Operation and Maintenance Plan [which includes the health and safety plan] was not present at the facility. Following are significant observations and results of discussions:

<u>Groundwater Treatment Facility:</u> The groundwater treatment facility was not in operation during the inspection. When in operation, groundwater from each pumping well is piped separately to the treatment building, where there is a separate flow monitor and sampling valve for each pumping well. In the treatment building the flows are combined and treated by air stripping. There is a separate sampling valve for the combined influent. The air stripping is performed in six prefabricated rectangular tanks, which are arranged two high to form three parallel stripping units. The groundwater is fed into the top three stripping tanks

and flows by gravity through these tanks into and through the bottom three tanks and into a concrete sump before discharging by gravity into the pipe that flows to the Branch River. The effluent is sampled from the sump. While the groundwater flows downward by gravity, an air compressor pushes air through piping through the sides of the tanks, through distribution piping within the tanks, upward through the tanks and piping exiting the top three tanks, and then emits to ambient air through three discharge pipes on the south side of the treatment building at about 15-20 feet above the ground. There are also three air intakes for the compressor on the south side of the building. Pressure gauges were observed on the air stripper tanks, and a differential pressure gauge observed.

Mr. Brooks explained that he has been starting up the pumping wells and running the treatment system for about two hours every three months. Mr. Brooks showed a piece of the air distribution piping, and explained that it becomes encrusted with calcium deposits. During full time operation, he has had to shut-down the system and clean the distribution piping with muriatic acid about every three weeks. He has to clean the tanks about every six months. He showed samples of the calcium deposits that can develop. The waste muriatic acid is diluted and then combined with the leachate in the leachate holding tanks for subsequent disposal. Mr. Clark reported that air emissions were tested when the system was first started up, but testing during subsequent operation was not required. Reportedly, WDNR concurred with the decision to not routinely monitor air emissions. Mr. Brooks said that RMT checked emissions using meters after there was a question from the public.

<u>Leachate Collection</u>: The leachate collection system was not operating during the inspection. The leachate building is heated and insulated. It holds three 10,000 gallon holding tanks for the leachate. Leachate has not been collected since December 2009, when EPA approved the temporary shut-down of the leachate collection. Mr. Brooks explained that the leachate was still being trucked off-site to the Heart of the Valley wastewater treatment plant, and all permits were up to date. Routine maintenance included pulling and cleaning (using muriatic acid) the leachate well pumps every three months, and using a vac truck to pump out the leachate wells once per year.

<u>Walk over LL</u>: We walked most of the perimeter the LL site cover. The site cover was very well vegetated. Mr. Brooks said that it was last mowed in October 2009. There were heavy thatch deposits, but Mr. Brooks has observed that the grass grows through this. We observed no evidence of leachate seeps, cracks, erosion damage, holes, or slope instability. Turf damage from the mowing was observed at one small location along the northern edge of the site cover. The site cover included a number of small dikes to divert groundwater flow, and some let-down channels protected by rip-rap. Overall, the site cover appeared to be well-sloped for draining. Some minor ponding of water was observed and should be monitored. Except along the southwestern corner of the property, where the fence is behind a wetland and woods, the six foot chain-link

fence was observed to be intact and undamaged. We observed the tops of some of the monitoring wells and leachate withdrawal wells. There was no evidence of emissions from the landfill vents (light refraction or odor).

<u>Walk over LTR</u>: We walked the perimeter and some of the interior of the LTR site cover. LTR is not elevated above surrounding land like LL and most other landfills. This is because LTR was used primarily for liquid and drum disposal, and not for large volumes of wastes. Perhaps 250 feet of land to the east of LTR, and 1000 feet south of LTR drains towards LTR. This land was being used for growing crops. The eastern and southern boundaries of LTR are sloped to direct drainage to the west to a drainage channel along the western boundary of the LTR site cover. This channel drains to the north and into a ditch along Sunny Slope Road. No erosion damage was observed in the ditch or drainage areas. Mostly one-inch diameter and smaller stumps of former saplings were observed in this drainage ditch, although some stumps were larger than one inch. Mr. Brooks said that the saplings grow fast. Mr. Dougherty advised that something be done to prevent growth of the larger plants.

Participants were surprised that there is a retention pond on the west side of LTR that collects drainage of the LTR site cover and also discharges to the ditch along the western side of LTR [Figure EW-3 of EPA's Remedial investigation appears to show that there was not waste disposal in the area of this retention pond]. Mr. Brook said that there is only water in the pond for a few days after a heavy rain. There was also a question of whether the southeastern corner of the property is capped or is outside of the contamination area [Figure ES-3 does not indicate that there was a waste disposal area in the southeast corner of the property], as it is outside the elevated area of the cap, but slopes up again outside the drainage area around the cap. It was noted that LTR site maps appear to show that the entire rectangular area is capped, and the retention pond and exclusion of the southeastern corner is not shown. More complete site maps were requested. It was noted that EPA staff could not locate an as-built drawing for the LTR site cover. Mr. Clark said that these are available and will request that RMT provide an as-built drawing to EPA.

Concrete rubble was present on the property, which is owned by others, at the western boundary of LTR. An existing excavation on that property indicated that the top of bedrock was only a few feet bgs.

The site cover was very well vegetated. Mr. Brooks said that it was last mowed in October 2009. There were thick deposits of thatch, but Mr. Brooks has observed that the grass will grow through this. We observed no evidence of leachate seeps, cracks, erosion damage, or slope instability. In general, the LTR site cover slopes to the west, but drainage is interrupted by a number of small dikes for directing drainage. Some rip-rap was also observed to protect letdown channels on the site cover. In general, the site cover was well sloped for drainage, but minor ponding of water was observed in front of some locations that were rip-rapped, and in few other areas. A number of varmint holes were observed along the west and east sides of the site cover. Clay soil was observed in the varmint's excavation spoil pile for one hole on the east side.

The six-foot chain link fence around LTR was intact except for damage observed near the middle of the southern boundary, and on the eastern side of the northern boundary. Warning signs were posted along the fence. Mr. Brooks said that the fence at the southern boundary was damaged when hit by an agricultural machine (the chain link was still up but was disconnected from one of the upright poles, and a couple of the horizontal poles were bent. Mr. Brooks said that the bottom of the chain-link along the northern boundary had been pushed out by pressure of accumulated snow outside the cover area. Mr. Brooks indicated that he would be making repairs.

We observed the pumping wells, sumps and monitoring wells along the boundaries of LTR. The question of whether the UGS was present along the western boundary of LTR was discussed because potentiometric surface maps appear to indicate that the UGS detected at RM-304D migrates to the west. Mr. Brooks said that when the pump at EW-1 was removed (in 2001?), there was no iron or calcium build up on the pump. The vaults were opened and pumping heads observed for EW-6, EW-8, EW-9 and one of the shallow groundwater sumps. About six inches of water was observed in the vault for EW-9, apparently because of a plugged drain. This could cause a problem with the electric connections for the flow meter / counter.

There was no evidence of air emissions from the landfill vents (light refraction or odor).

<u>Bedrock at quarry and road cuts</u>: Quarrying operations were conducted in the past on part of the farm at the southern boundary of LTR. The quarry is about 1000 feet southwest of LTR. One small road cut was located on Hampton Road approximately 1000 feet south of LTR, exposed the dolostone. A second road cut was about 1 mile southwest of LTR. Mr. Wedekind, Mr. Dougherty, and Ms Weissbach observed the bedrock features with great interest. Features observed included: horizontal bedding planes, vertical fractures, solution channels, vugs and coral rock. According to Mr. Wedekind, although there were significant openings in bedding planes and fractures, all of the openings that he was able to closely observe were finite in extent and mineralized. Mr. Wedekind was able to insert his arm about two feet into one hole and observed that it was mineralized inside, and interpreted the hole to be a vug. The potential for connectivity of the openings was discussed.

Surface drainage features from the LTR area to the Branch River were observed in the return trip from the second road cut

ACTION ITEMS

1. Inasmuch as the Operation and Maintenance Plan and Health and Safety Plan were not present at the facility, evaluate whether adequate instructions are available to the site operator.
2. Recover documentation on air emissions, and the decision that monitoring of air emissions was not necessary.
3. Develop maintenance procedures to prevent large saplings from growing in the drainage ditches.
4. Consider how infiltration of the large volumes of surface water near LTR (drainage from fields east and south of the site to drainage channels near LTR, and drainage from site cover to drainage channels and retention basin) may be impacting groundwater contaminant release and migration.
5. Distribute as-built drawings of the LTR site cover to the reviewers. Also prepare a map overlaying the extent of the site cover over the location of the waste disposal areas (Figure ES-3).
6. The extent and shape of the LTR site cover should be included in future project maps.
7. Perform routine site cover maintenance, including repairing the cap where varmints caused damage.
8. Perform routine fence maintenance.
9. Perform routine maintenance of well vaults, including cleaning the drain for EW-9.
10. Review soil boring logs to determine whether or not the UGS may be present along the western boundary of LTR.

Exhibit 29: Figure 1, Leachate Head Evaluation Report, October 2007

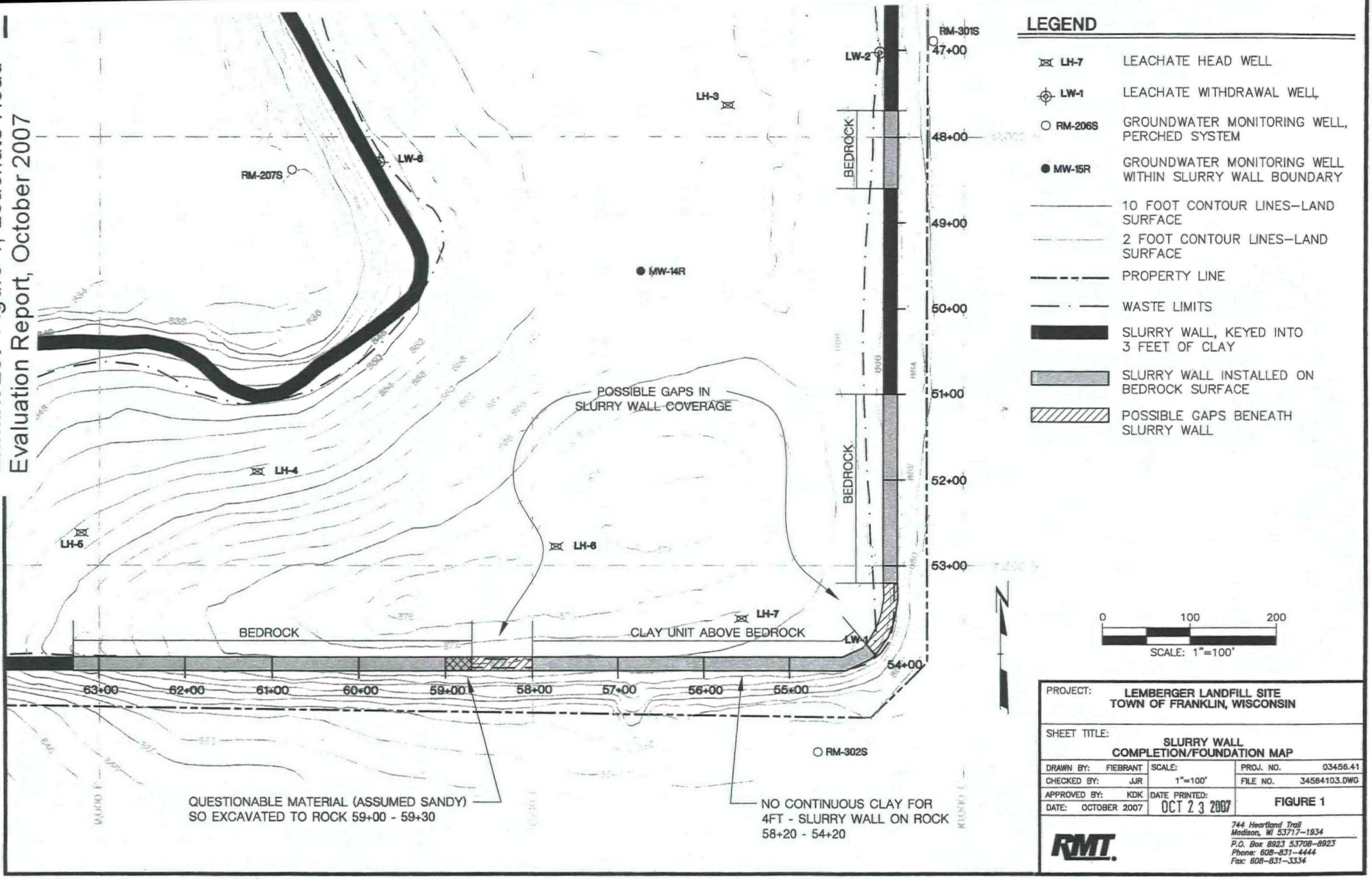
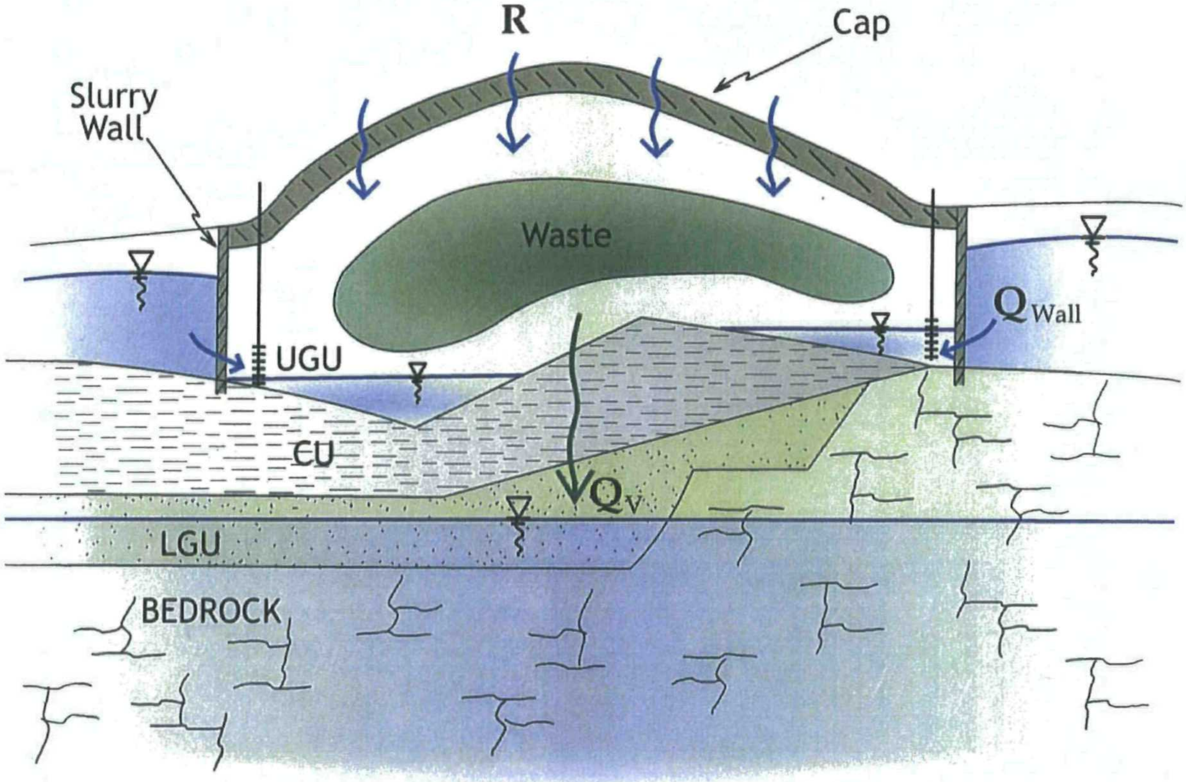


Exhibit 30: Figure 5, Leachate Head Evaluation Report for the Lemberger Landfill, RMT, February 2010

REVISED
LEMBERGER LANDFILL
CONCEPTUAL LIQUIDS BALANCE



$$\Delta S \approx R + Q_{Wall} - Q_V$$

ΔS = Change in Storage

R = Recharge

Q_{Wall} = Seepage Through Slurry Wall

Q_V = Vertical Drainage Out of Landfill

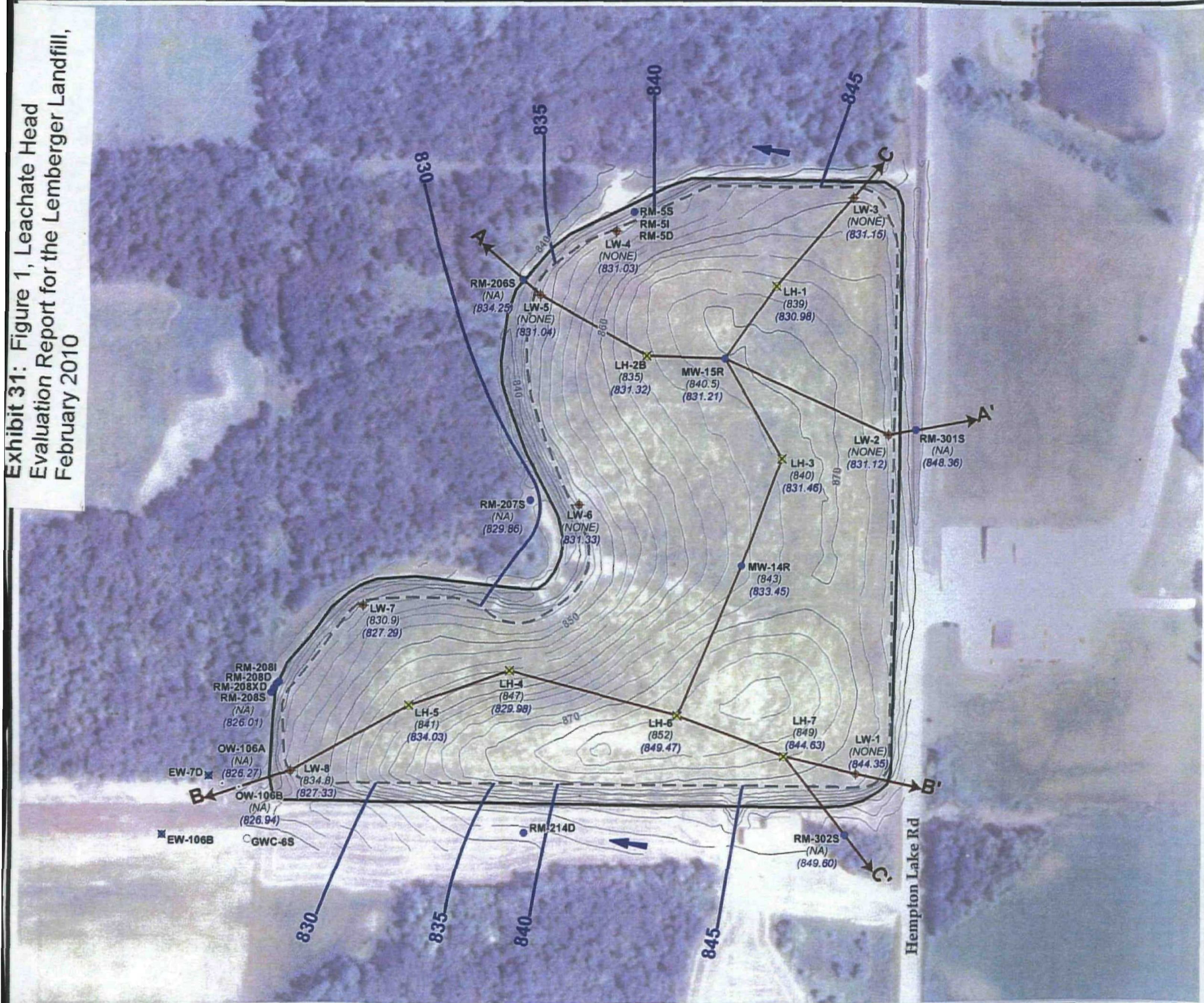
NOTE: This drawing was revised to remove the extraction component (Q_{EX}) due to results of the recent monitoring effort.

RMT — 744 Heartland Trail, Madison, WI 53717-1934; P.O. Box 8923 53708-8923; Phone: 608-831-4444; Fax: 608-831-3334	LEMBERGER LANDFILL TOWN OF FRANKLIN, WISCONSIN	DRAWN BY:	PAPEZ J
		APPROVED BY:	JMR
	REVISED LANDFILL LIQUIDS BALANCE	PROJECT NO:	3459.40
		FILE NO.	345940xsec04.ai
		DATE:	FEBRUARY 2010

D:\03459\40\GIS\Doc\XSEC\345940xsec04.ai

FIGURE 5

Exhibit 31: Figure 1, Leachate Head Evaluation Report for the Lemberger Landfill, February 2010



LEGEND

- GW COLLECTION SUMP (GWC)
- GW EXTRACTION WELL (EW)
- GW OBSERVATION WELL (OW)
- LEACHATE HEAD WELL (LH)
- LEACHATE WITHDRAWL WELL (LW)
- MONITORING WELL (RM)
- SLURRY WALL (APPROXIMATE)
- PERCHED WATER TABLE CONTOURS OUTSIDE OF THE SLURRY WALL (5' INTERVAL)
- CROSS SECTION LINES
- LANDFILL AREA (APPROXIMATE)

NA	NOT APPLICABLE (WELL LOCATED OUTSIDE LANDFILL LIMITS)
NONE	NO WASTE PRESENT AT LOCATION
(843)	TOP NUMBER: BOTTOM OF WASTE ELEV., FT. MSL
(833.45)	BOTTOM NUMBER: GROUNDWATER OR LEACHATE ELEV., FT. MSL

- GROUNDWATER FLOW DIRECTION

NOTES

1. AERIAL IMAGERY FROM USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM, SUMMER, 2008.

N

0 200 400 FEET
1" = 200'
1:2,400

PROJECT: LEMBERGER LANDFILL TOWN OF FRANKLIN, WISCONSIN			
SHEET TITLE: PLAN VIEW / CROSS-SECTION LOCATOR			
DRAWN BY: PAPEZJ	SCALE: AS NOTED	PROJ. NO.	00-003459.40
CHECKED BY: JEW		FILE NO.	34594001.mxd
APPROVED BY: JMR	DATE PRINTED: FEB 0 2 2010	FIGURE 1	
DATE: FEBRUARY 2010			

RMT

744 Heartland Trail
Madison, WI 53717-1934

P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

D:\03459\40\MXD\34594001.mxd 2/2/2010 12:40:17

Table 2
Leachate Analytical Summary

WELL NUMBER	SAMPLE DATE	CHLORO-BENZENE	CHLORO-ETHANE	1,1-DCA	1,1-DCE	1,2-DCA	1,2-DCE, TOTAL	1,2-DICHLORO-PROPANE	METHYLENE CHLORIDE	TCE	1,1,1-TCA	1,1,2-TCA	PCE	VINYL CHLORIDE	BTEX TOTAL
LH-01	7/13/2000	--	--	--	--	--	--	--	--	--	--	--	--	--	12.51
	12/2/2008	--	--	--	--	--	--	--	--	--	--	--	--	--	0.65
LH-02B	7/12/2000	--	--	0.71Q	--	--	--	--	--	--	--	--	--	--	4.6
	12/3/2008	0.62Q	--	--	--	--	--	--	--	--	--	--	--	--	1.6
LH-03	7/12/2000	--	--	--	--	--	0.95Q	--	--	--	--	--	--	--	1.3
	12/4/2008	2.2	--	--	--	--	--	--	--	--	--	--	--	--	2.6
LH-04	7/13/2000	--	300	640	2.7Q	13	13,000D	8.3	--	6.9Q	--	--	--	900	3,720
LH-05	7/13/2000	1.0Q	--	2.0	--	--	6.1	1.2	--	0.56Q	--	--	--	--	408.6
LH-06	7/13/2000	--	21	1,200D	2.8	35	10,000D	5.6	9,600D	47	380D	6.8	6.8	290D	1,405
LH-07	7/13/2000	7.6	--	--	--	--	2.3Q	--	--	--	--	--	--	--	128.1
MW-14R	3/14/2001	3.7	--	2.1	--	--	99	2	--	1.8	--	--	--	21	109.4
MW-15R	7/12/2000	0.50Q	--	--	2.2	--	1,800D	--	--	--	--	--	--	290D	8.2
	12/4/2008	--	--	--	--	--	40	--	--	--	--	--	--	16.4	0.9

Notes:

D = Dilution factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

Q = Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

All units are in µg/L.

-- = Compound was not detected.

Trace concentrations of carbon disulfide and chloromethane were excluded for this summary.

Qualifiers not included when calculating BTEX value.

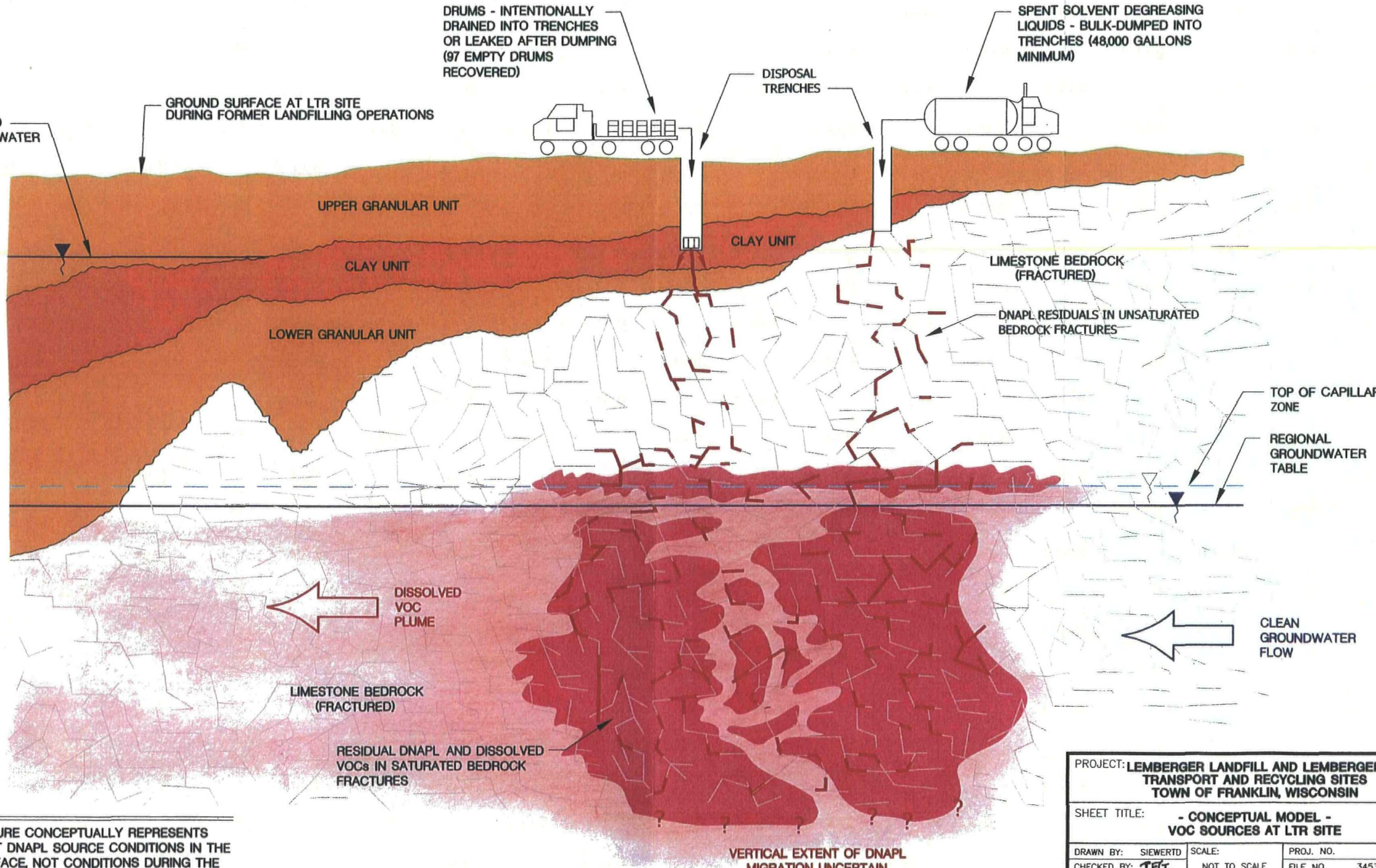
Exhibit 33: RMT submittal
April 17, 2009.

Table
Summary of Sen's Slope Statistical Analyses
Lemberger Landfill and Lemberger Transport and Recycling Sites

WELL	ALL HISTORICAL DATA				DATA SINCE MNA START-UP			
	1,1,1-TCA	1,1-DCA	TOTAL-1,2-DCE(1)	TCE	1,1,1-TCA	1,1-DCA	CIS-1,2-DCE	TCE
RM-002D	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No detections	No trend	No detections	No trend
RM-002I	Decreasing trend	Decreasing trend	No trend	Decreasing trend	No trend	No trend	No trend	No detections
RM-003D	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend
RM-003I	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend	No detections	No detections
RM-004D	**Increasing trend**	**Increasing trend**	No detections	No detections	No detections	No detections	No detections	No detections
RM-005D	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend
RM-005I	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend
RM-007D	No trend	**Increasing trend**	**Increasing trend**	No trend	No trend	No trend	No trend	No trend
RM-007XD	**Increasing trend**	**Increasing trend**	**Increasing trend**	**Increasing trend**	No trend	No trend	No trend	No trend
RM-008D	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend
RM-010D	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend	No trend	No trend
RM-101D	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No detections	No trend
RM-103D	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend
RM-203D	No trend	Decreasing trend	No trend	No trend	No trend	No trend	No trend	No trend
RM-203I	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend	No detections	No detections
RM-204D	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No trend	No trend	No trend	Decreasing trend
RM-204I	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend
RM-208D	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No trend	No trend	No trend
RM-208I	Decreasing trend	Decreasing trend	No trend	Decreasing trend	No trend	No trend	No detections	No detections
RM-209D	Decreasing trend	**Increasing trend**	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend
RM-210D	Decreasing trend	No trend	Decreasing trend	No trend	No trend	No trend	No trend	Decreasing trend
RM-210I	Decreasing trend	Decreasing trend	Decreasing trend	Decreasing trend	No trend	No trend	No trend	No trend
RM-211D	No trend	No trend	No detections	No trend	No trend	No trend	No detections	No trend
RM-213D	No trend	No trend	No data	No trend	No trend	No trend	No trend	No trend
RM-214D	No trend	No trend	No data	No trend	No trend	No trend	No trend	No trend
RM-303D	Decreasing trend	No trend	No trend	No trend	No trend	No trend	No trend	No trend
RM-304D	Decreasing trend	No trend	No detections	Decreasing trend	Decreasing trend	No detections	No detections	No detections
RM-305D	Decreasing trend	No detections	No detections	Decreasing trend	No trend	No detections	No detections	No trend
RM-306D	Decreasing trend	**Increasing trend**	Decreasing trend	No trend	No trend	No trend	No trend	No trend
RM-307D	Decreasing trend	**Increasing trend**	**Increasing trend**	Decreasing trend	No trend	No trend	No trend	No trend
RM-308D	No trend	No detections	No detections	No detections	No trend	No detections	No detections	No detections

Notes:
(1) Prior to the MNA demonstration, only total-1,2-dichloroethene was reported; reporting of the cis- and trans- isomers began with the "baseline analysis" in July 2006, prior to the MNA demonstration period.

Exhibit 34: Figure 7, Assessment of Remedial Action Effectiveness, RMT, June 2004.



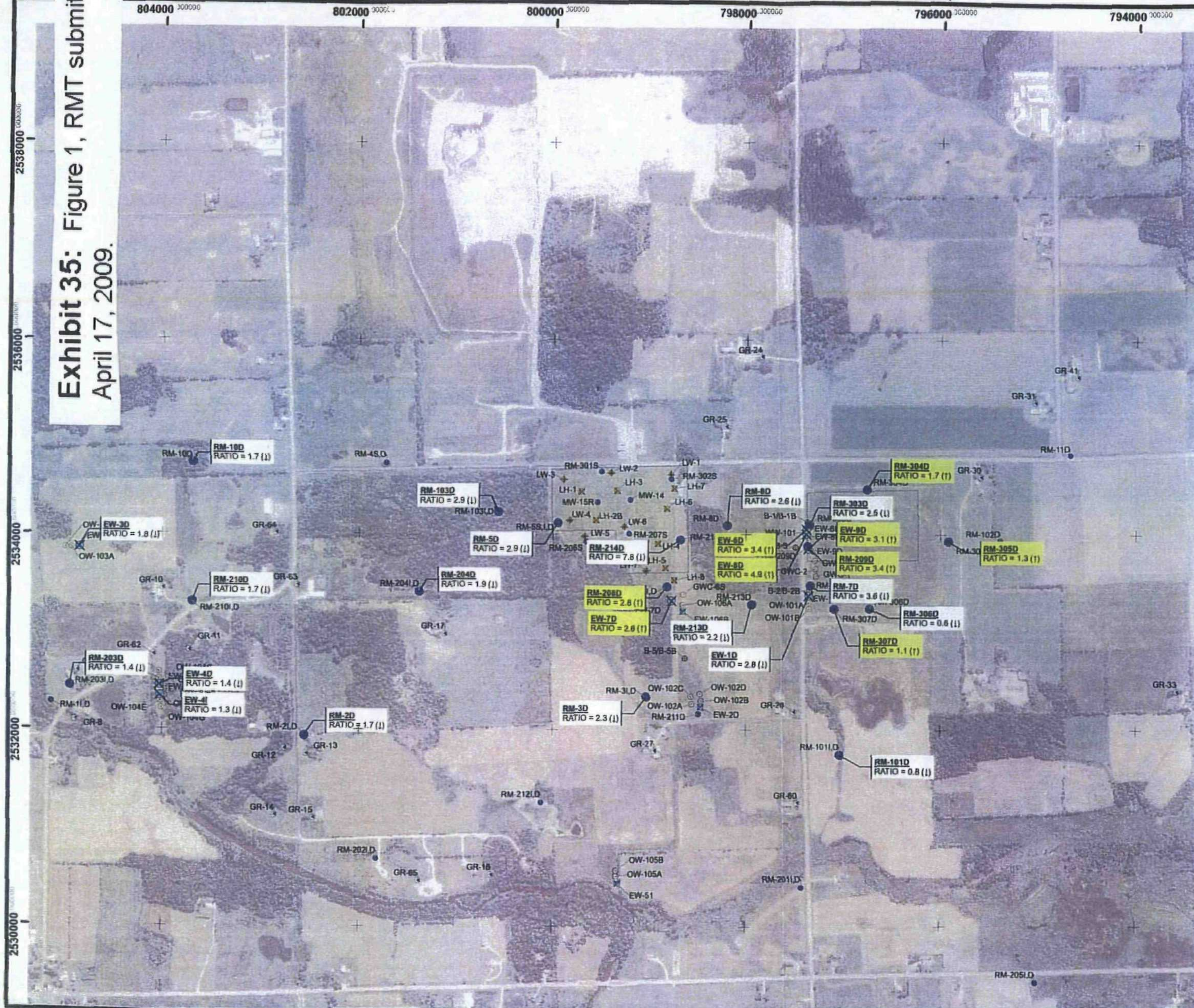
NOTES

1. THIS FIGURE CONCEPTUALLY REPRESENTS CURRENT DNAPL SOURCE CONDITIONS IN THE SUBSURFACE, NOT CONDITIONS DURING THE ORIGINAL LANDFILL DISPOSAL OPERATIONS.
2. TIME REQUIRED FOR DNAPL TO MOVE FROM DISPOSAL TRENCHES INTO SATURATED BEDROCK AND BECOME IMMOBILIZED AFTER EACH DISPOSAL EVENT WAS LIKELY A FEW HOURS TO A FEW DAYS.

PROJECT: LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN		
SHEET TITLE: - CONCEPTUAL MODEL - VOC SOURCES AT LTR SITE		
DRAWN BY: SIEWERTD	SCALE:	PROJ. NO. 03453.40
CHECKED BY: TEG	NOT TO SCALE	FILE NO. 34534005.DWG
APPROVED BY: TEG	DATE PRINTED:	FIGURE 7
DATE: JUNE 2004	JUN 3 0 2004	

RMT.
744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

Exhibit 35: Figure 1, RMT submittal April 17, 2009.



LEGEND

- BEDROCK BORING
- GW COLLECTION SUMP
- GW EXTRACTION WELL; WET WELL
- GW OBSERVATION WELL
- LEACHATE HEAD WELL
- LEACHATE WITHDRAWL WELL
- MONITORING WELL
- RESIDENTIAL WELL
- LANDFILL AREA

MONITORING LOCATION SHOWING UPWARD TREND IN cis 1,2 DCE TO TCE RATIO

SAMPLE ID
RATIO OF DCE/TCE (TREND DIR.)

MONITORING LOCATION SHOWING DOWNWARD TREND IN cis 1,2 DCE TO TCE RATIO

SAMPLE ID
RATIO OF DCE/TCE (TREND DIR.)

NOTES

1. AERIAL IMAGERY FROM USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM, 2008.
2. MAP COORDINATES ARE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FEET.

0 1,000 2,000 FEET
1" = 1,000'
1:12,000

PROJECT: **LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN**

SHEET TITLE: **TRENDS IN RATIO BETWEEN CIS 1,2 DCE AND TCE**

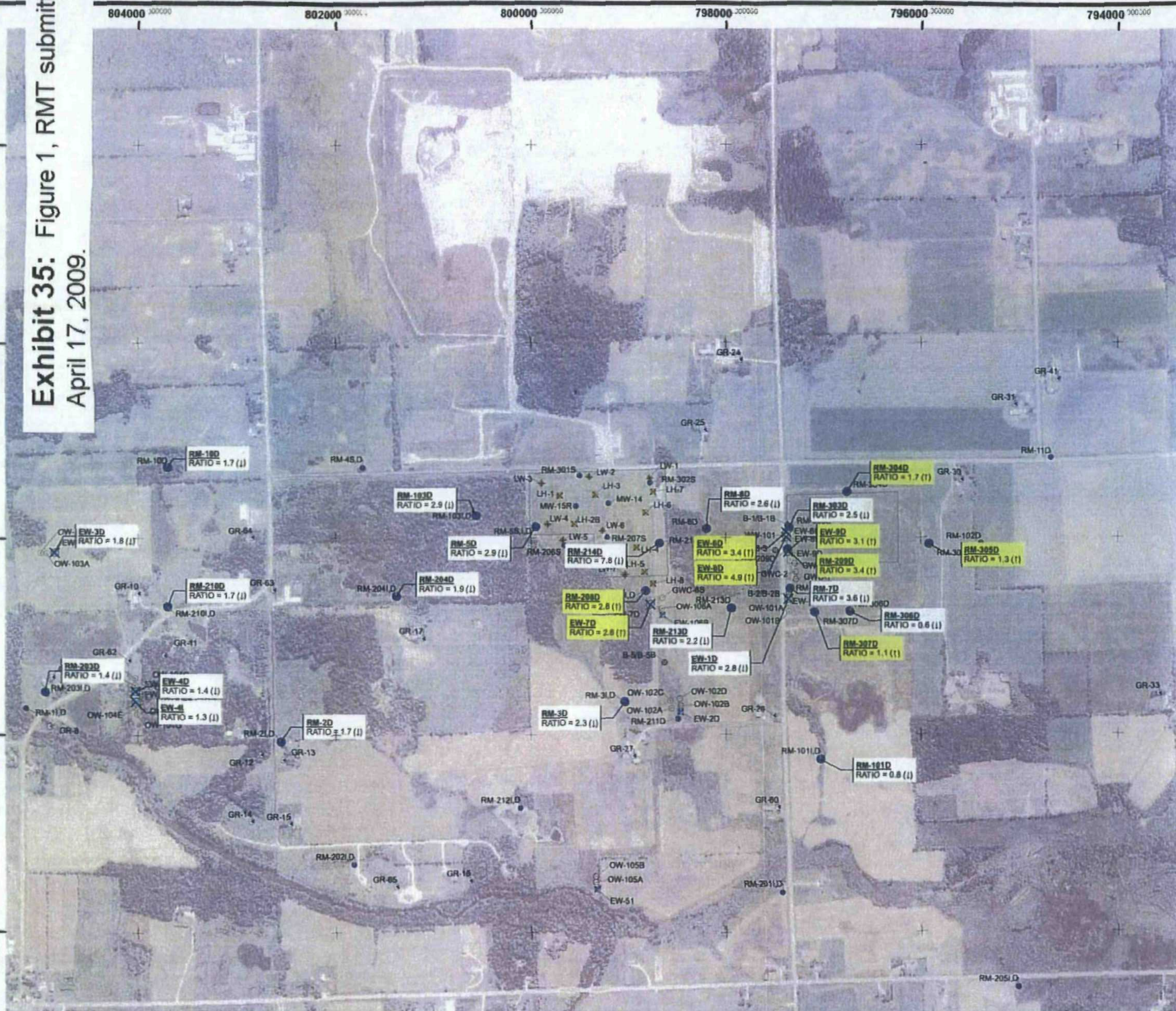
DRAWN BY: PAPEZ J	SCALE:	PROJ. NO.	00-003458.40
CHECKED BY: JR	AS NOTED	FILE NO.	34584001.mxd
APPROVED BY: JW	DATE PRINTED:		
DATE: APRIL 2009	4/17/2009	**FIGURE 1**	

RMT

744 Heartland Trail Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

D:\03458\40\mxd\34584001.mxd 4/17/2009 10:18:52

Exhibit 35: Figure 1, RMT submittal April 17, 2009.



D:\034584\0\mxd\34584001.mxd 4/17/2009 10:18:52

LEGEND

- BEDROCK BORING
- GW COLLECTION SUMP
- GW EXTRACTION WELL; WET WELL
- GW OBSERVATION WELL
- LEACHATE HEAD WELL
- LEACHATE WITHDRAWL WELL
- MONITORING WELL
- RESIDENTIAL WELL
- LANDFILL AREA

MONITORING LOCATION SHOWING UPWARD TREND IN cis 1,2 DCE TO TCE RATIO

SAMPLE ID
RATIO OF DCE/TCE (TREND DIR.)

MONITORING LOCATION SHOWING DOWNWARD TREND IN cis 1,2 DCE TO TCE RATIO

SAMPLE ID
RATIO OF DCE/TCE (TREND DIR.)

NOTES

1. AERIAL IMAGERY FROM USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM, 2008.
2. MAP COORDINATES ARE WISCONSIN STATE PLANE, SOUTH ZONE, NAD 83, US SURVEY FEET.

0 1,000 2,000 FEET

1" = 1,000'
1:12,000

PROJECT: LEMBERGER LANDFILL AND LEMBERGER TRANSPORT AND RECYCLING SITES TOWN OF FRANKLIN, WISCONSIN			
SHEET TITLE: TRENDS IN RATIO BETWEEN CIS 1,2 DCE AND TCE			
DRAWN BY: PAPEZ J	SCALE:	PROJ. NO.	00-003458.40
CHECKED BY: JR	AS NOTED	FILE NO.	34584001.mxd
APPROVED BY: JW	DATE PRINTED:	FIGURE 1	
DATE: APRIL 2009	4/17/2009		

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744 Heartland Trail
Madison, WI 53717-1934
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Phone: 608-831-4444
Fax: 608-831-3334

Exhibit 36: As-built drawing of LTR site cover, RMT, December 20, 1995

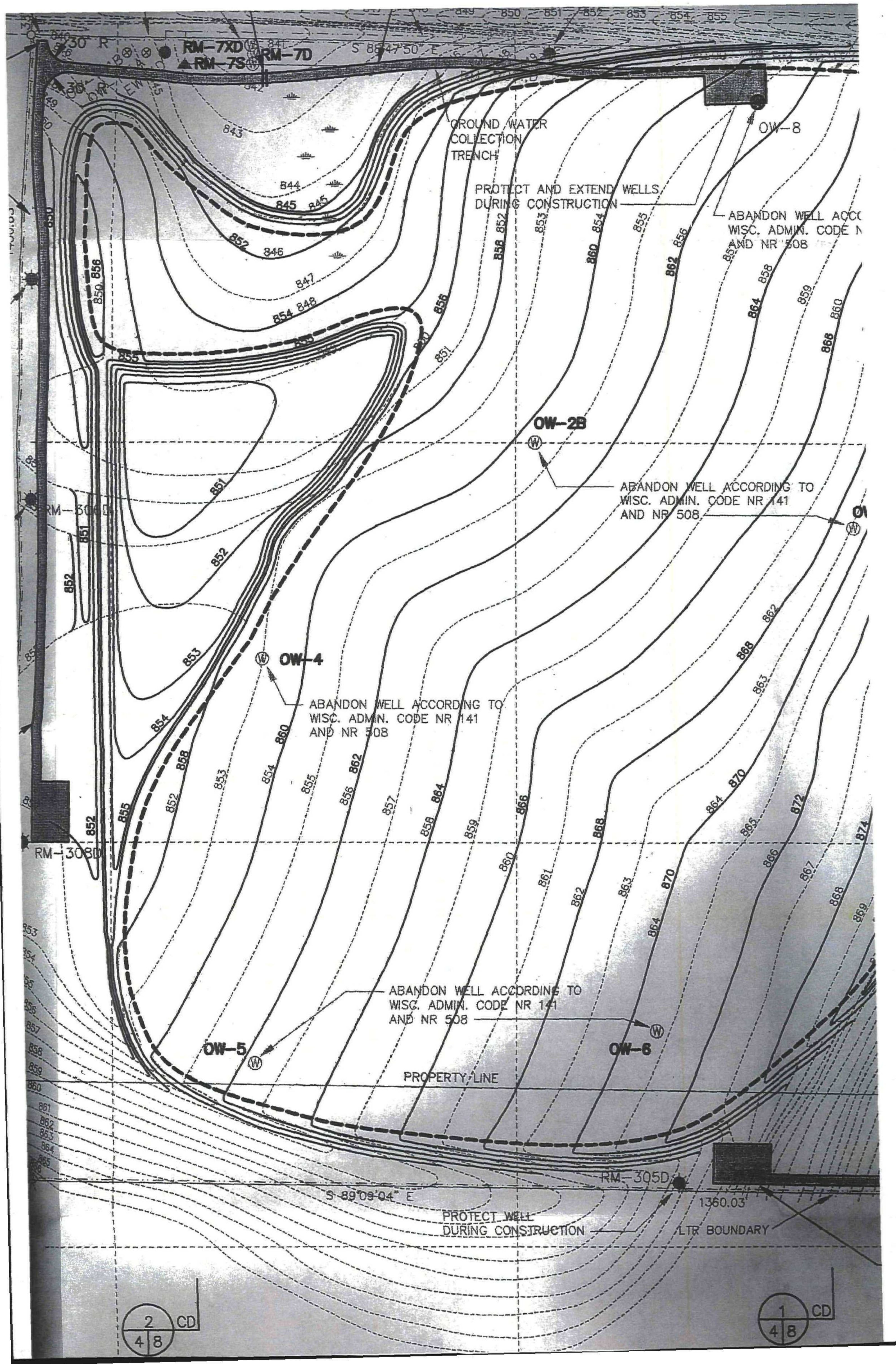
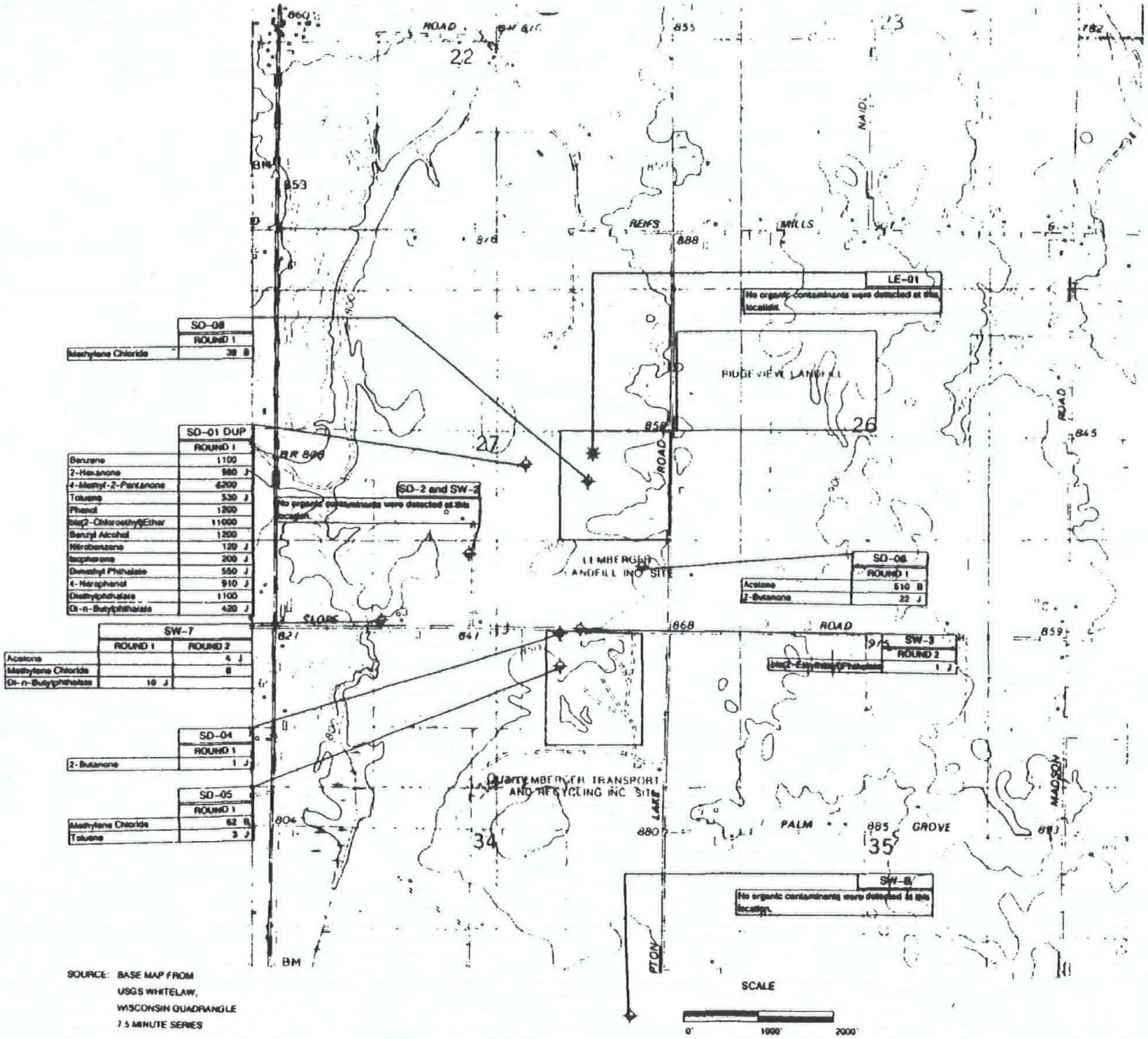


Exhibit 37:



SOURCE: BASE MAP FROM USGS WHITELAW, WISCONSIN QUADRANGLE 7.5 MINUTE SERIES

LEGEND

SEDIMENT AND SURFACE WATER SAMPLE LOCATION

LEACHATE SAMPLE LOCATION

DATA QUALIFIER DEFINITIONS FOR ORGANIC ANALYSES

J - VALUE IS ESTIMATED.

B - COMPOUND DETECTED IN BLANK.

NOTES

SEDIMENT CONCENTRATIONS IN ug/kg.

SURFACE WATER AND LEACHATE CONCENTRATIONS IN ug/L.

A BLANK MEANS CONSTITUENT WAS NOT DETECTED AT CONCENTRATIONS ABOVE DETECTION LIMITS.

FIGURE 4-13
ORGANIC ANALYTICAL RESULTS SUMMARY
FOR SEDIMENT, SURFACE WATER, AND LEACHATE
LEMBERGER SITES RI REPORT

(22) "Wastewater and sludge storage or treatment lagoon" means a natural or man–made containment structure, constructed primarily of earthen materials for the treatment or storage of wastewater or sludge, which is not a land disposal system.

History: Cr. Register, September, 1985, No. 357, eff. 10–1–85; cr. (1m), am. (7), (17) and (18), Register, October, 1988, No. 394, eff. 11–1–88; am. (6), cr. (20h) and (20m), Register, March, 1994, No. 459, eff. 4–1–94; cr. (1s), (10e), (10s), (20k), r. and recr. (12), (13), Register, August, 1995, No. 476, eff. 9–1–95; cr. (14m), Register, October, 1996, No. 490, eff. 11–1–96; am. (20), Register, December, 1998, No. 516, eff. 1–1–99; correction in (9) made under s. 13.93 (2m) (b) 7., Stats., Register, April, 2001, No. 544; CR 02–134: cr. (1u), (1w), (1y) and (20s) Register June 2003 No. 570, eff. 7–1–03.

Subchapter II — Groundwater Quality Standards

NR 140.10 Public health related groundwater standards. The groundwater quality standards for substances of public health concern are listed in Table 1.

Note: For all substances that have carcinogenic, mutagenic or teratogenic properties or interactive effects, the preventive action limit is 10% of the enforcement standard. The preventive action limit is 20% of the enforcement standard for all other substances that are of public health concern. Enforcement standards and preventive action limits for additional substances will be added to Table I as recommendations are developed pursuant to ss. 160.07, 160.13 and 160.15, Stats.

Table 1
Public Health Groundwater Quality Standards

Substance[1]	Enforcement Standard (micrograms per liter – except as noted)	Preventive Action Limit (micrograms per liter – except as noted)
Acetone	1000	200
Alachlor	2	0.2
Alachlor ethane sulfonic acid (Alachlor–ESA)	20	4
Aldicarb	10	2
Antimony	6	1.2
Anthracene	3000	600
Arsenic	10	1
Asbestos	7 million fibers per liter (MFL)	0.7 MFL
Atrazine, total chlorinated residues	3[2]	0.3[2]
Bacteria, Total Coliform	0[3]	0[3]
Barium	2 milligrams/liter (mg/l)	0.4 mg/l
Bentazon	300	60
Benzene	5	0.5
Benzo(b)fluoranthene	0.2	0.02
Benzo(a)pyrene	0.2	0.02
Beryllium	4	0.4
Boron	960	190
Bromodichloromethane	0.6	0.06
Bromoform	4.4	0.44
Bromomethane	10	1
Butylate	400	80
Cadmium	5	0.5
Carbaryl	960	192
Carbofuran	40	8
Carbon disulfide	1000	200
Carbon tetrachloride	5	0.5
Chloramben	150	30
Chlordane	2	0.2
Chloroethane	400	80
Chloroform	6	0.6
Chloromethane	3	0.3
Chromium	100	10
Chrysene	0.2	0.02
Cobalt	40	8
Copper	1300	130
Cyanazine	1	0.1
Cyanide	200	40
Dacthal	70	14
1,2–Dibromoethane (EDB)	0.05	0.005
Dibromochloromethane	60	6
1,2–Dibromo–3–chloropropane (DBCP)	0.2	0.02

Table 1 – Continued
Public Health Groundwater Quality Standards

Substance[1]	Enforcement Standard (micrograms per liter – except as noted)	Preventive Action Limit (micrograms per liter – except as noted)
Dibutyl phthalate	100	20
Dicamba	300	60
1,2–Dichlorobenzene	600	60
1,3–Dichlorobenzene	1250	125
1,4–Dichlorobenzene	75	15
Dichlorodifluoromethane	1000	200
1,1–Dichloroethane	850	85
1,2–Dichloroethane	5	0.5
1,1–Dichloroethylene	7	0.7
1,2–Dichloroethylene (cis)	70	7
1,2–Dichloroethylene (trans)	100	20
2,4–Dichlorophenoxyacetic Acid (2,4–D)	70	7
1,2–Dichloropropane	5	0.5
1,3–Dichloropropene (cis/trans)	0.2	0.02
Di (2–ethylhexyl) phthalate	6	0.6
Dimethoate	2	0.4
2,4–Dinitrotoluene	0.05	0.005
2,6–Dinitrotoluene	0.05	0.005
Dinoseb	7	1.4
Dioxin (2, 3, 7, 8–TCDD)	0.00003	0.000003
Endrin	2	0.4
EPTC	250	50
Ethylbenzene	700	140
Ethylene glycol	7 mg/l	0.7 mg/l
Fluoranthene	400	80
Fluorene	400	80
Fluoride	4 mg/l	0.8 mg/l
Fluorotrichloromethane	3490	698
Formaldehyde	1000	100
Heptachlor	0.4	0.04
Heptachlor epoxide	0.2	0.02
Hexachlorobenzene	1	0.1
N–Hexane	600	120
Hydrogen sulfide	30	6
Lead	15	1.5
Lindane	0.2	0.02
Mercury	2	0.2
Methanol	5000	1000
Methoxychlor	40	4
Methylene chloride	5	0.5
Methyl ethyl ketone (MEK)	460	90
Methyl isobutyl ketone (MIBK)	500	50
Methyl tert–butyl ether (MTBE)	60	12
Metolachlor	15	1.5
Metribuzin	250	50
Molybdenum	40	8
Monochlorobenzene	100	20
Naphthalene	100	10
Nickel	100	20
Nitrate (as N)	10 mg/l	2 mg/l

Unofficial Text (See Printed Volume). Current through date and Register shown on Title Page.

Table 1 – Continued
Public Health Groundwater Quality Standards

Substance[1]	Enforcement Standard (micrograms per liter – except as noted)	Preventive Action Limit (micrograms per liter – except as noted)
Nitrate + Nitrite (as N)	10 mg/l	2 mg/l
Nitrite (as N)	1 mg/l	0.2 mg/l
N–Nitrosodiphenylamine	7	0.7
Pentachlorophenol (PCP)	1	0.1
Phenol	6 mg/l	1.2 mg/l
Picloram	500	100
Polychlorinated biphenyls (PCBs)	0.03	0.003
Prometon	90	18
Pyrene	250	50
Pyridine	10	2
Selenium	50	10
Silver	50	10
Simazine	4	0.4
Styrene	100	10
1,1,1,2–Tetrachloroethane	70	7
1,1,2,2–Tetrachloroethane	0.2	0.02
Tetrachloroethylene	5	0.5
Tetrahydrofuran	50	10
Thallium	2	0.4
Toluene	1 mg/l	0.2 mg/l
Toxaphene	3	0.3
1,2,4–Trichlorobenzene	70	14
1,1,1–Trichloroethane	200	40
1,1,2–Trichloroethane	5	0.5
Trichloroethylene (TCE)	5	0.5
2,4,5–Trichlorophenoxy–propionic acid (2,4,5–TP)	50	5
1,2,3–Trichloropropane	60	12
Trifluralin	7.5	0.75
Trimethylbenzenes	480	96
(1,2,4– and 1,3,5– combined)		
Vanadium	30	6
Vinyl chloride	0.2	0.02
Xylene[4]	10 mg/l	1 mg/l

[1] Appendix I contains Chemical Abstract Service (CAS) registry numbers, common synonyms and trade names for most substances listed in Table 1.

[2] Total chlorinated atrazine residues includes parent compound and the following metabolites of health concern: 2–chloro–4–amino–6–isopropylamino–s–triazine (formerly deethylatrazine), 2–chloro–4–amino–6–ethylamino–s–triazine (formerly deisopropylatrazine) and 2–chloro–4,6–diamino–s–triazine (formerly diaminoatrazine).

[3] Total coliform bacteria may not be present in any 100 ml sample using either the membrane filter (MF) technique, the presence–absence (P–A) coliform test, the minimal medium ONPG–MUG (MMO–MUG) test or not present in any 10 ml portion of the 10–tube multiple tube fermentation (MTF) technique.

[4] Xylene includes meta–, ortho–, and para–xylene combined. The preventive action limit has been set at a concentration that is intended to address taste and odor concerns associated with this substance.

History: Cr. Register, September, 1985, No. 357, eff. 10–1–85; am. table 1, Register, October, 1988, No. 394, eff. 11–1–88; am. table 1, Register, September, 1990, No. 417, eff. 10–1–90; am. Register, January, 1992, No. 433, eff. 2–1–92; am. Table 1, Register, March, 1994, No. 459, eff. 4–1–94; am. Table 1, Register, August, 1995, No. 476, eff. 9–1–95; am. Table 1, Register, December, 1998, No. 516, eff. 1–1–99; am. Table 1, boron, Register, December, 1998, No. 516, eff. 12–31–99; am. Table 1, Register, March, 2000, No. 531, eff. 4–1–00; CR 03–063: am Table 1, Register February 2004 No. 578, eff. 3–1–04; CR 02–095: am. Table 1, Register November 2006 No. 611, eff. 12–1–06; reprinted to correct errors in Table 1, Register January 2007 No. 613; **CR 07–034: am. Table 1 Register January 2008 No. 625, eff. 2–1–08.**

NR 140.12 Public welfare related groundwater standards. The groundwater quality standards for substances of public welfare concern are listed in Table 2.

Note: For each substance of public welfare concern, the preventive action limit is 50% of the established enforcement standard.

Table 2
Public Welfare Groundwater Quality Standards

Substance	Enforcement Standard (milligrams per liter – except as noted)	Preventive Action Limit (milligrams per liter – except as noted)
Chloride	250	125
Color	15 color units	7.5 color units
Foaming agents MBAS (Methylene–Blue Active Substances)	0.5	0.25
Iron	0.3	0.15
Manganese	0.05	0.025
Odor	3 (Threshold Odor No.)	1.5 (Threshold Odor No.)
Sulfate	250	125
Zinc	5	2.5

History: Cr. Register, September, 1985, No. 357, eff. 10–1–85; am. table 2, Register, October, 1990, No. 418, eff. 11–1–90; am. Table 2, Register, March, 1994, No. 459, eff. 4–1–94.

NR 140.14 Statistical procedures. **(1)** If a preventive action limit or an enforcement standard for a substance listed in Table 1 or 2, an alternative concentration limit issued in accordance with s. NR 140.28 or a preventive action limit for an indicator parameter established according to s. NR 140.20 (2) is attained or exceeded at a point of standards application:

(a) The owner or operator of the facility, practice or activity at which a standard is attained or exceeded shall notify the appropriate regulatory agency that a standard has been attained or exceeded; and

(b) The regulatory agency shall require a response in accordance with the rules promulgated under s. 160.21, Stats. No response shall be required if it is demonstrated to the satisfaction of the appropriate regulatory agency that a scientifically valid determination cannot be made that the preventive action limit or enforcement standard for a substance in Table 1 or 2 has been attained or exceeded based on consideration of sampling procedures or laboratory precision and accuracy, at a significance level of 0.05.

(2) The regulatory agency shall use one or more valid statistical procedures to determine if a change in the concentration of a substance has occurred. A significance level of 0.05 shall be used for all tests.

(3) In addition to sub. (2), the following applies when a preventive action limit or enforcement standard is equal to or less than the limit of quantitation:

(a) If a substance is not detected in a sample, the regulatory agency may not consider the preventive action limit or enforcement standard to have been attained or exceeded.

(b) If the preventive action limit or enforcement standard is less than the limit of detection, and the concentration of a substance is reported between the limit of detection and the limit of quantitation, the regulatory agency shall consider the preventive action limit or enforcement standard to be attained or exceeded only if:

1. The substance has been analytically confirmed to be present in the same sample using an equivalently sensitive analytical method or the same analytical method, and

2. The substance has been statistically confirmed to be present above the preventive action limit or enforcement standard, determined by an appropriate statistical test with sufficient samples at a significance level of 0.05.

(c) If the preventive action limit or enforcement standard is between the limit of detection and the limit of quantitation, the regulatory agency shall consider the preventive action limit or enforcement standard to be attained or exceeded if the concentration of a substance is reported at or above the limit of quantitation.

History: Cr. Register, September, 1985, No. 357, eff. 10–1–85; am. (1) (intro.) and (b), r. and recr. (2), Register, October, 1988, No. 394, eff. 11–1–88; am. (1) (b), (2) and (3) (b), Register, September, 1990, No. 417, eff. 10–1–90; am. (1) (b), Register, March, 1994, No. 459, eff. 4–1–94; r. and recr. (3) (intro.), (a), (b), renum. (3) (c) to be 140.16 (5) and am., Register, August, 1995, No. 476, eff. 9–1–95.

NR 140.16 Monitoring and laboratory data requirements. **(1)** (a) All groundwater quality samples collected to determine compliance with ch. 160, Stats., shall comply with this section except as noted.

(b) *Groundwater sampling requirements.* All groundwater quality samples shall be collected and handled in accordance with procedures specified by the applicable regulatory agency or, where no sampling procedures are specified by that agency, in accordance with the sampling procedures referenced in par. (c). The sampling procedures specified by a regulatory agency may include requirements for field filtration.

(c) *Department groundwater sampling procedures.* 1. If sampling procedures are not specified by the applicable regulatory agency pursuant to par. (b), all groundwater quality samples shall be collected and handled in accordance with the sampling procedures contained in the following publications:

a. Groundwater Sampling Desk Reference. Wisconsin Department of Natural Resources, PUBL–DG–037–96, September, 1996.

b. Groundwater Sampling Field Manual. Wisconsin Department of Natural Resources, PUBL–DG–038–96, September, 1996.

Note: Copies of these publications may be purchased from:
Wisconsin Department of Administration
Document Sales Unit
202 South Thornton Avenue
P.O. Box 7840
Madison, WI 53707–7840
These publications are available for inspection at the offices of the department, the secretary of state and the legislative reference bureau.

2. Where no procedure for collecting a particular groundwater quality sample is specified by the appropriate regulatory agency or in the publications referenced in subd. 1., other published scientifically valid groundwater sampling procedures may be used.

(d) *Laboratory requirements.* All groundwater quality samples, except samples collected for total coliform bacteria analysis and field analyses for pH, specific conductance and temperature, shall be analyzed in accordance with provisions of ch. NR 149 by a laboratory certified or registered under ch. NR 149. Samples for total coliform bacteria analysis shall be analyzed by the state labo-